EFFECTIVENESS OF VISION THERAPY AS AN ADJUNCT TO OCCUPATIONAL THERAPY IN IMPROVING VISUAL MOTOR SKILLS IN LEARNING DISABLED CHILDREN

A PROJECT WORK SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF OCCUPATIONAL THERAPY

(ADVANCED O.T. IN PAEDIATRICS)

Submitted by

Reg. No. 411613054

JKK MUNIRAJAH MEDICAL RESEARCH FOUNDATION COLLEGE

OF OCCUPATIONAL THERAPY

KOMARAPALAYAM - 638183

Affiliated to

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY,

CHENNAI-600032

APRIL – 2018

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PRINCIPAL EXTERNAL EXAMINER

GUIDE INTERNAL EXAMINER

CERTIFICATE

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

ABSTRACT

OBJECTIVE

The purpose of the study is to determine the effectiveness of occupational therapy in improving Visual Motor skills along with vision therapy in children with learning disability.

METHOD

In this study a total of 30 children from the age group of 7 to 10 years participated, and were divided into 15 each in experimental and control group. The control group received only Occupational Therapy where as the experimental group received both Occupational Therapy and Vision Therapy. The Visual Motor Integration scale was used as the outcome measure for both the groups at the start of intervention and later after 3 months intervention. The data's were recorded and analyzed for statistical analysis.

RESULTS

Statistical significance is present in experimental group than control group with regard to effect of vision therapy activities with occupational therapy intervention.The data analyzed, the pretest score of control group 12.33 and post test score being 13.07, where as in experimental group the pretest score 12.53 and post test score 15.40.The paired 't'test for experimental group is $p < 0.01$.

CONCLUSION

The findings of study suggest, "Vision therapy when given along with Occupational Therapy has significant effect on improving Visuo Motor integration skills" in children with learning disability.

Key words

Learning disability, Visuo Motor skills, Vision therapy activities, Occupational therapy Intervention.

INTRODUCTION

"Learning disability is defined as a disorder in one of the more basic psychological process involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write or do mathematical calculation - from public law 94 – 142, the Education for All handicapped Children Act.

Learning disability constitutes a diverse group of disorders in which children who generally posses at-least average intelligence have problems processing information or generating output.

In India the reported prevalence of specific learning disabilities is 15.17 % among 8 - 11 years old children. As reading is a primary concern under the Specific Learning Disorder, it also raises concern about the efficiency of visual system that could contribute to the reading impairment. Specific domains of reading , written expression and mathematics with reading are the majorly affected domain.[29]

Learning disabilities have also been associated with poor occulomotorcontrol.[21] Just as language and motor skills are achieved through a sequence of developmental stages, vision must also follow a progression of development. An infant is not born with the visual abilities that he will need in order to function successfully in his world. When language or motor skills development is interrupted, parents and teachers seek to identify the problem and intervene with therapy or training activities designed to assist the child in overcoming the delay. It was argued that visual deficit in learning disabilityoccur as a consequence of a poorly developed magnocellular system.[27]

When we speak of vision, we are referring to the ability of the brain to organise and interpret the information seen so it becomes understandable or meaningful .Even individual with good sight (20/20) acuity, can have undiagnosed vision problems that make it difficult to correctly comprehend the visual message.

Vision therapy

Vision therapy is an individualised, supervised, treatment program designed to correct visual motor and or perceptual - cognitive deficiencies.Vision plays integral role in the motor control process as it establishes what is referred to as a state estimate for an individual[15]. It is a sequence of activities individually prescribed and monitored todevelop efficient visual skills and processing.Vision therapy sessions include procedures designed to enhance the brains ability to control:

- Eye movement
- Visual processing
- Eye alignment
- Eye tracking and eye teaming
- Eye focusing abilities

Vision therapy can help those individuals who lack necessary visual skills for effective reading, writing and learning. Vision therapy is a kind of occupational therapy for the eyes and brain. Combining vision therapy with occupational therapy results in an integrated solution. Overallcoordinationis improved, which in turn affects performance in school.Good vision requires child's eyesight, visual pathways and brain to all work together.When they don't, even 20/20 eyesight can experience

difficulty reading, writing and processing information. The children learn how to correctly process the visual information that the brain receives from the eyes.

Vision therapy, when combined with occupational therapy seems to dramatically enhance the benefits of both therapeutic treatment programs in children with attention, and learning problems. Many parents have reported positive results with this approach, particularly if occupational and vision therapy is done on intensive basis stated Apple Baum.

Difference between Vision therapy and Occupational therapy

We do not treat the eyes as separate isolated entities, but as a part of the total eye - mind - body connection. Vision therapy involves specific activities designed to improve eye teaming, focussing, eye movement, depth perception, visual motor skills, visualisation and visual perception.

Occupational therapy is a series of sensory /motor activities specifically designed to enhance gross / fine motor activities specifically balance / equilibrium, postural control, bilateral awareness, gross motor planning, tactile awareness and tolerance and eye - hand coordination.

Visual motor integration

Visual Motor Integration is the ability of the eyes and hands to work together in smooth and efficient patterns. Visual Motor skills involves visual perception and eye handco-ordination.Visual motor skills require the ability to translate visual perception into motor functioning and involve motor control, motor accuracy,motor co- ordination, and psychomotor speed.Manyresearchers have explained the importance of Visual Motor Integration in learning academic skills.The Beery's

Developmental Test of Visual Motor Integration (DVMI) has been extensively used in order to measure the integration problems in children.According to Beery, "visual motor integration is defined as the ability to copy geometric shapes"[35].He suggested that the first nine figures in this DVMI should be mastered before achild learns to write. Many researchers have found high correlation of DVMI with writing readiness, handwriting, copying abilities, reading, mathematical abilities, academic performance in children.[35]

OPERATIONAL DEFINITION

FEDERAL DEFINITION OF A LEARNING DISABILITY

"Specific learning disability" means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes (but is not limited to) such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

Having a single term to describe this category of children with disabilities reduces some of the confusion, but there are many conflicting theories about what causes learning disabilities and how many there are. The label "learning disabilities" is all-embracing; it describes a syndrome, not a specific child with specific problems. The definition assists in classifying children, not teaching them. Parents and teachers need to concentrate on the individual child.

OPERATIONAL DEFINITION OF A LEARNING DISABILITY

1. The student does not receive information commensurate with his/her age and ability levels in one or more of seven specific areas when provided with learning experiences appropriate for the child's age and ability level.

2. The student has a significant discrepancy between achievement and intellectual ability in one or more of the following areas.

Oral expression, listening comprehension, written expression, basic reading skill, reading comprehension, mathematical calculation, mathematical reasoning.

Visual motor integration

According to Beery, visual motor integration is defined as the ability to copy geometric shapes. It is the ability of the eyes & hands to work together in smooth, efficient patterns. It involves visual perception and eye hand coordination. Visual motor integration translates visual perception into motor functioning and involves motor control, motor accuracy, motor coordination and psychomotor speed.

Visual motor skills have been defined as “the ability to integrate the visual image of letters or shapes with appropriate motor response”

VISION THERAPY

Vision therapy is a sequence of neurosensory and neuromuscular activities individually prescribed and monitored by the therapist to develop, rehabilitate and enhance visual skills and processing.It is a, customized program of visual activities designed to correct certain vision problems and/or improve visual skills. Vision therapy is like physical therapy for the visual system, including the eyes and the parts of the brain that control vision.

NEED FOR THE STUDY

The purpose of this study is to evaluate the assumption that Occupational therapy provided along with vision therapy to children with learning disability in the age group of 7 to 10 will show significant improvement in their visual motor skills.VMI is a consistent predictor of academic performance through second grade, as well as reliable instrument to be used with young preschool population[12][49]

This study is the first study conducted in combination (i.e.) Occupational therapy and vision therapy, though there are studies where vision therapy for the learning disabled, vision therapy for autism studies have been conducted without combination of any other therapy.[15] [11]

With right support and intervention, however children with learning disabilities can succeed in school and go on to successful, often distinguished careers later in life. Parents can help children with learning disabled achieve such success by encouraging their strengths, knowing their weakness, understanding the educational system, working with professionals and learning about strategies for dealing with specific difficulties.[8] [4]

If child has been diagnosed with a learning disability or is experiencing challenges with their academics, an Occupational therapist can be a valuable support. Occupational therapist help children gain independence and develop new skills to enable participation in learning. Occupational therapist work closely with them to optimise their engagement at school and in home environment. They usually work on

the underlying motor problems, attentional challenges or visual perceptual deficits that may be contributing to or cause academic difficulties for the child.

Vision therapy trains the entire visual system which includes eyes, brain and body. It is a form of neurological training or rehabilitation (it can be compared to some forms of Occupational therapy) The goal of vision therapy is to train the patient's brain to use the eyes to receive information effectively ,comprehend it quickly and react appropriately. [15].

AIM AND OBJECTIVE

AIM:

The aim of the study is to determine the effectiveness of occupational therapy in improving Visual motor skills along with vision therapy in children with Learning disability.

OBJECTIVES:

- To assess the effectiveness of conventional occupational therapy to improve visual motor skills in children with Learning disability.
- To assess the effectiveness of vision therapy along with Occupational therapy to improve visual motor skills in children with Learning disability.
- To determine the difference between the levels of effectiveness with and without vision therapy in children with Learning disability.

HYPOTHESIS

ALTERNATE HYPOTHESIS

Effect of Occupational therapy along with vision therapy will have significant effect on improving visuomotor skills among the learning disabled children.

NULL HYPOTHESIS

Effect of occupational therapy along with Vision therapy will have no significant effect on improving visuomotor skills among the learning disabled children.

"**Learning disabilities**" is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to central nervous system dysfunction[19].

A learning disability is an information-processing deficit. Most researchers believe that it is neurologically based. There are many kinds of learning disabilities and they affect the way people receive, process, store, and respond to information. Government policies documents in England and Northern Ireland use the definition of the term 'Learning disabilities' from valuing people (Department of health 2001). As the definitions in Scotland and Wales are similar, that same definition is used in this research and the term can therefore be taken to mean the presence of:

- a significantly reduced ability to understand new or complex information and to learn new skills.
- a reduced ability to cope independently which started before adulthood and had a lasting effect on development.[4]

Prevalence of learning disabilities

The study suggests that the prevalence of learning disabilities is at higher side of previous estimations in India. Poor school performance or 'scholastic backwardness' is estimated to affect one in every five school children. The studies to measure prevalence of learning disabilities in India are scanty and its importance is under recognized.[50]. The prevalence of specific learning disabilities was 15.17% in

sample children, where as 12.5 %, 11.2% and 10.5% had dysgraphia, dyslexia, and dyscalculia.[50] Difficulty with basic reading and language skills are the most common learning disabilities. As many as 80% of students with learning disabilities have reading problems. Learning disabilities often run in families.[5]

Learning disabilities are due to genetic and neurological factors or injury that alters brain function in a manner that affects one or more process relate to learning. These disorders are not due primarily to hearing and or vision problems, social economic factors, cultural or linguistic differences, lack of motivation, inadequate or insufficient instruction, although this factor may further complicate the challenges faced by individuals with learning disabilities. [8]

Common learning disabilities:[3]

- Dyslexia – a language-based disability in which a person has trouble understanding written words. It may also be referred to as reading disability or reading disorder.
- Dyscalculia – a mathematical disability in which a person has a difficult time solving arithmetic problems and grasping math concepts.
- Dysgraphia – a writing disability in which a person finds it hard to form letters or write within a defined space.
- Auditory and Visual Processing Disorders – sensory disabilities in which a person has difficulty understanding language despite normal hearing and vision.
- Nonverbal Learning Disabilities – a neurological disorder which originates in the right hemisphere of the brain, causing problems with visual-spatial, intuitive, organizational, evaluative and holistic processing functions.

Etiology[7]

Research on possible causes and the exact nature of learning disabilities are ongoing. The literature identifies several possible contributing factors. These include neurobiological differences, genetic factors, and other risk factors.

Neurobiological Differences

Though neuroimaging techniques it has been determined that there are subtle structural and functional brain differences in individuals with learning disabilities (Kibby&Hynd, 2001).Brain imaging techniques have identified neural pathways involved in reading. The parieto – temporal system and Brocas areas are located on left side and the front of the brain respectively. These areas are linked to analyzing words, and linking sounds to letters. Beginning readers and people with reading disability show most activity in these areas.

As readers become fluent they show most activity in Occipito – temporal systems located at the back of the brain. The area is a hub of activity, receiving information about how a word looks, how it sounds and what it means. Those with learning disabilities demonstrate a pattern of under activity in this area of the brain (shaywitz, 2003) [7].

Genetic Factors

Developmental differences of the brain associated with learning disabilities are thought to be influenced by genetic factors. Genetic markers for reading disabilities have been identified on chromosome 6 and 15 (shaywitz, 2003) [7]

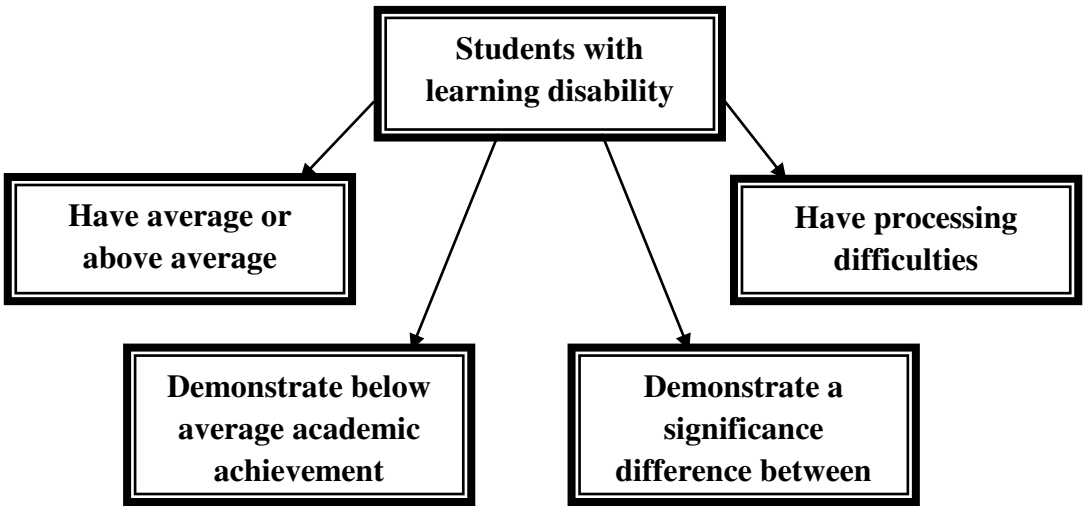
Learning disabilities may run in families. Parents of a student with a learning disability may indicate that they had similar learning patterns in school. However it is important to remember that a parent's learning disability may manifest differently in the child.

Other Risk factors

Other possible contributing factors include problems during pregnancy caused by the use of tobacco, alcohol, and other drugs. Mothers who smoke may be more likely to have low birth weight babies who may be at risk for variety of problems. Alcohol and drugs consumed by a mother during pregnancy transfer directly to the foetus. Environmental toxins are also being investigated as possible causes of learning disabilities (souse, 2011)[(7)].

Features of learning disabilities

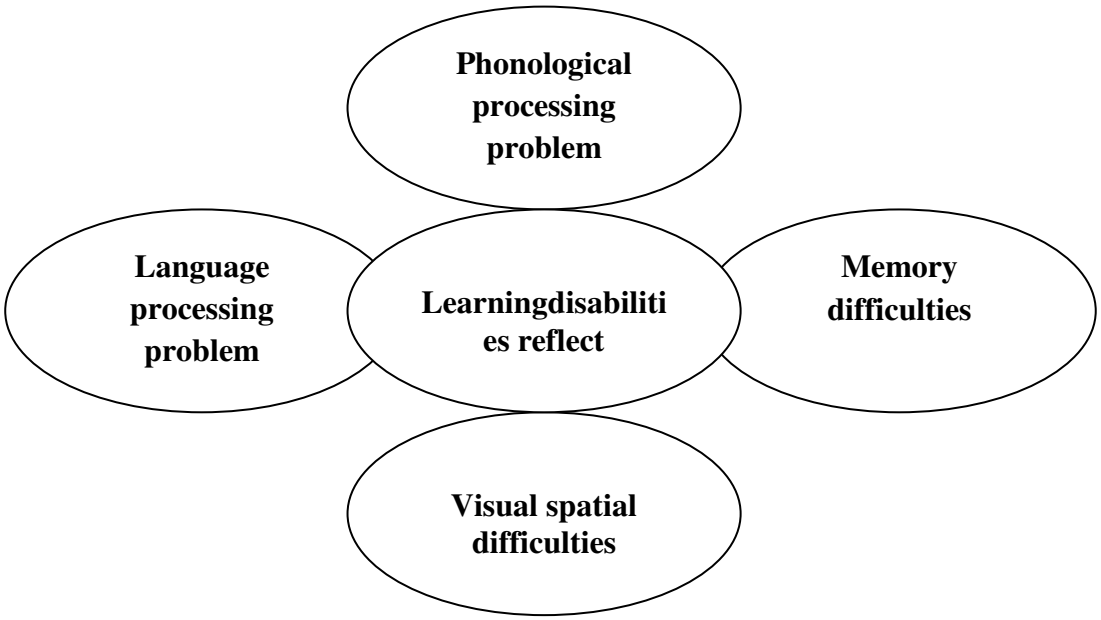
Recognizing a student with Learning disability



COMMON SIGNS

The following is a checklist of characteristics that may point to a learning disability are very common. Most people will, from time to time, see one or more of these warning signs in their children. This is normal. If, however, you see several of these characteristics over a long period of time, consider the possibility of a learning disability.[3]

- Reverses letter sequences (soiled/solid, left/felt)
- Slow to learn prefixes, suffixes, root words, and other spelling strategies
- Avoids reading aloud
- Trouble with word problems
- Difficulty with handwriting
- Awkward, fist-like, or tight pencil grip
- Avoids writing assignments
- Slow or poor recall of facts
- Difficulty making friends
- Trouble understanding body language and facial expressions[3]



Diagnostic Criteria (DSM5)

In 2013, the American Psychiatric Association released the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM5). In this latest edition, specific learning disorder (SLD) is the umbrella term for mathematics, reading, and written expression disorders. It is now a single, overall diagnosis, incorporating deficits that impact academic achievement. Rather than limiting learning disorders to diagnoses particular to reading, mathematics and written expression, the criteria describe shortcomings in general academic skills and provide detailed specifies for the areas of reading, mathematics, and written expression. The diagnosis requires persistent difficulties in reading, writing, arithmetic, or mathematical reasoning skills during formal years of schooling.

Intervention of occupational therapy among individuals with learning disabilities

Goals and objectives of treatment[(5)]

- Increase in the frequency or duration of adaptive responses to sensory input
- Development of increasingly more complex adaptive responses
- Increase in self confidence and self esteem
- Improvement in cognitive skills, language acquisition, or academic achievement
- Improvement in daily living and personal - social skills.

Occupational therapy intervention approaches and methods for individuals with learning disabilities take into account the person him/herself with respect to the his/her abilities and disabilities and learning style, as well as to the environment in which the intervention is carried out. In addition, the approaches are adapted with respect to the occupations that individuals want and need to perform in the environments in which they functions.

On the basis of an analysis of the factors mentioned, occupational therapists suggest an intervention program that focuses on the person, the task to be performed and the environment in which it is to be performed. Occupational therapy intervention may be carried out as direct, individual therapy; through a group process (group therapy); and / or by consulting with the individuals, their families and the other people in their environment (educational teams, work teams, etc).

The intervention is directed towards adapting the activities and / or the environment of the individual in order to enable him/her to realize his/her full potential. The occupational therapy evaluation and intervention are carried out in various environments, such as in a clinic and/or in the person's natural environment (at home, class, playground, work place, etc).

The Sensory integration approach [5]

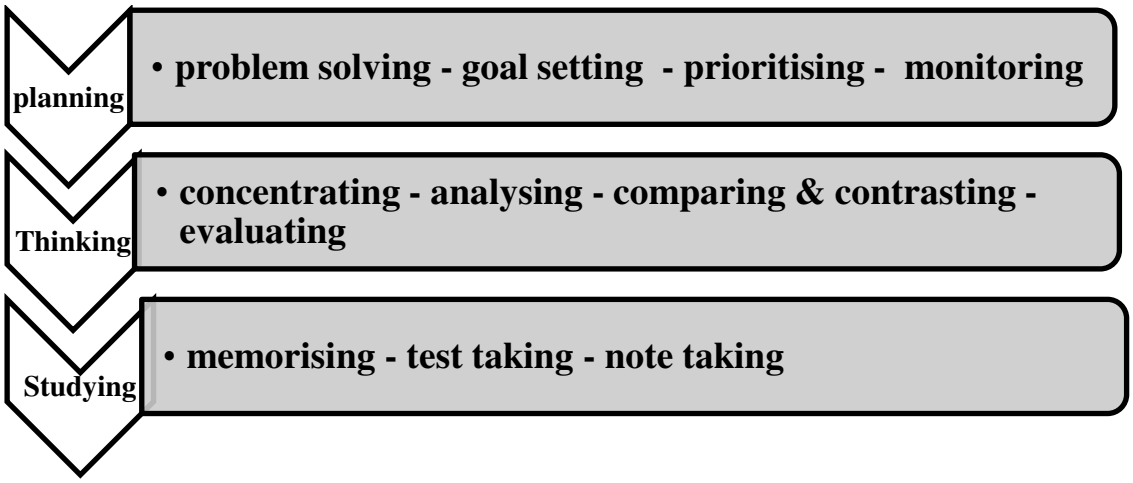
Sensory integrative procedures are widely used in occupational therapy practice with children with learning disabilities. The application of Sensory integrative theory practice can be summarized through explication of the following principles that are drawn from Ayres.

Controlled sensory input can be used to elicit an adaptive response .Ayres define adaptive response as "**an appropriate action in which the individual responds successfully to some environmental demand**''

- An adaptive response contributes to the development of sensory integration
- The more inner directed a child's activities, the greater the potential of the activities for improving neural organization.

- More mature and complex patterns of behaviour are composed of consolidation more primitive behaviours.
- Better organization of adaptive response will enhance the Childs general behavioural organization.
- Registration of meaningful sensory input is necessary before an adaptive response can be made during the course of a day, individuals notice some but not all of theStimuli in their environment.

Learning Strategies adopted by therapist[9]



Visual Motor Integration (VMI)

Involves effective, efficient communication between the eyes and the hands, so that you are able to copy, draw or write what you see. Visual Motor Integration (VMI) is the ability to see eyes and handswork together in smooth, efficient patterns .It involves visual perception and eye - hand coordination. Visual - motor skills require the ability to translate visual perception into motor functioning and involve motor control, motor accuracy, motor coordination, and psychomotor speed. Many researchers have explained the importance of VMI in learning academic skills [35]

According to Beery, Visual motor integration is defined as the ability to copy geometric shapes. It is evident from literature the learning disabled children do suffer from visual - motor integration deficit and Occupational therapy intervention helps in remediation[35]The children who do not develop this visual - motor integrative skill may present difficulties in learning[27]

1. **Visual skill foundation is established through the development of:**

✓Visual perceptual skills

✓Functional visual skills (such as eye tracking, and convergence)

✓Eye hand coordination

2. **Motor skills foundation:**

The motor skills foundation is established through the development

✓Shoulder girdle stability

✓Fine motor skills

✓Eye hand co ordination

Visual motor integration is an important variable to a child's handwriting skills, particularly when copying or transposing from printing material to cursive or manuscript writing. There are various factors like visual-perceptual, motor planning, motor memory, sequencing etc. for handwriting performance but Sovik found visual-motor integration was the most significant predictor of handwriting performance.

Many researchers have explained the importance of VMI in learning academic skills. Beery believes that before the child learns to write, the basic geometric shapes have to be mastered.It has been observed that as subject's ability to copy the forms on

the VMI increases, a concomitant increase in ability to copy letters accurately is seen, which was supported by Weil in his study.Mati-zissi observed that there is a correlation between performance in written language and drawing or design copying tasks.Failure on visual-motor tests may be caused by underlying visual-cognitive deficits including visual discrimination, poor fine motor skills, inability to integrate visual – cognitive and motor processes, or combination of these abilities.

The Berry's Developmental Test of Visual Motor Integration (DVMI) has been extensively used in order to measure the integration problems in children.. He suggested that the first nine figures in this DVMI should be mastered before a child learns to write. [35] Subsequently many researchers have found high correlation of DVMI with writing readiness, handwriting skills, coping abilities, reading, mathematical abilities, and academic performance in children. The VMI appeared to be most predictive of the STAR, SESAT mathematics and word reading [14]

The deficits in VMI have been observed in learning disabled children. Since learning disabilities are closely associated with international problems, the reproduction of geometric forms may be a relatively sensitive measure of neurological integrity.Tranopol reports that 90% of learning disabled children has visual motor defects.[35]Learning disabled children with poor visual-motor integration have difficulty in doing the fine activities like drawing geometric forms, cutting with scissors, copying design, pasting, colouring etc. Mattison analyzed the visual-motor problems of children with learning disabilities and found that they had significantly more trouble than normal children with design-copy tasks involving visual-motor components.Oliver found significant improvement in children's writing readiness skill[14].

Developmental stages: two to three years

Stability and coordination

- The child can stabilize his body and shoulders during hand activities.
- He will try to stabilize his forearm when sitting at a table.
- He can paint at an ease, but has trouble colouring within the lines.
- He will mirror actions in the opposite hand during new or difficult motor tasks like cuttingwith scissors

Pencil grip and dominance

The child's grip changes from "palmar-supinate" where all fingers grasp the pencil in the direction of the tip, to "tripod," where the thumb and index finger grasp the pencil in the direction of the tip and the pencil rests between the thumb and index finger.

There is frequent switching of hands. The role of the "helper" or non dominant hand emerges.

Developmental stages: three to four years

Stability and coordination

- The child's trunk and shoulders are stabilized during fine motor activities; the shoulders and elbows provide refined control. Good wrist control is developing.
- Colouring improves.
- Mouth and mirroring movements are still observed.

Pencil grip and dominance

- The child now uses the static tripod grasp (thumb, index, and middle fingers hold the pencil; hand moves as a unit).
- There is frequent switching of hands. Use of the "helper" or non-dominant hand to stabilize and position work improves.

Visual-Motor Integration

- The child can copy circles, vertical, and horizontal lines from a model.
- He uses these shapes to draw pictures and copy words.
- He can copy simple block designs of three or four blocks.

Developmental stages: four to five years

Stability and coordination

- The wrist now provides some stability for controlled movements of the forearm and hand.
- The child can colour within the lines but may have some trouble forming letters.
- Mirroring movements have disappeared, but "overflow" movements, such as a tongue sticking out during cutting, still occur.

Pencil grip and dominance

- The child's grip varies between static tripod grip where the hand moves as a unit, and dynamic tripod grip in which small finger movements more finely control the pencil.
- Fingers are used to alter grip rather than using the other hand.
- Preferred hand is used predominantly.

Visual - Motor Integration

- Vision guides the hand when completing mazes.
- Letters are recognized, but may be “drawn” instead of printed (using proper letterformation).
- Some children print certain letters from memory.

Developmental stages: five to six years

Stability and coordination

- The child easily adjusts the posture of his trunk, arm, wrist, and fingers as needed for the task. Movements are efficient, finger dexterity is good, and many skills are automatic and are no longer visually guided.
- Printing skills improve, letters become smaller, and the child no longer has to copy from a model.

Pencil grip and dominance

- The child uses a dynamic tripod grip. The pencil is held near the tip. Finger movements guide small formations in printing.
- Dominance is firmly established.

Visuomotor integration skills

- The child copies diagonal lines and integrates them into triangles and diamonds.
- Printing becomes automatic by the end of kindergarten.
- The child does not need a model for reference when printing.
- The child can copy designs made from at least six blocks.

Signsofvisuomotor skill Deficit

- Poor scanning of visual material
- Difficulty controlling a pencil or crayon ; poor pencil grip
- Trouble staying within the lines when colouring at five years of age.
- Trouble copying simple shapes, such as horizontal and vertical lines circles and squares after5 years age.
- Trouble crossing the midline when writing, that is, crossing from left to right or right to left, for example, when drawing a cross (+)
- Poor use of paper when drawing, for example, only drawing on the lower or upperportion, or on one side of the page.
- Lack of interest in drawing
- Lack of interest in puzzles
- Trouble recognizing letters and numbers
- Trouble printing letters and numbers
- Frequent letter reversal in written work by end of grade one

Effect in the classroom

Poor development ofvisuomotor skills will also affect a child in the classroom. The following may be signs that the child is having problems in this regard. The following may be signs that the child is having problems in this regards.

- Slower recognition of letters and numbers, which in turn delays development of reading,spelling,printing and math skills.

- Slower acquisition of proper letter formation, which affects speed and ease in completing written assignments, and ultimately affects productivity in the classroom.
- Excessive need to focus attention on letter formation, which leaves less attention available forthe content of the message.
- Difficulty copying from the black board.

Occupational Therapy Intervention for Visuomotor Skills

- Acquisition frame of reference - the therapist shapes the behaviours that contribute to skill acquisition, the goal of intervention.
- Developmental frame of reference - it emphasizes the continuous modification and emergence of skills with age
- Fine motor activities - art, craft, finger plays, small manipulative
- Gross motor activities - obstacle Course, music dancing, over head ball throwing.

Vision Therapy

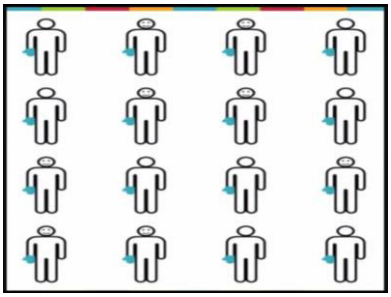
Vision therapy is a sequence of neurosensory and neuromuscular activities individually prescribed and monitored by the Rehabilitation professionals to develop, rehabilitate and enhance visual skills and processing. Vision therapy is a proven therapy that is well documented in medical journals,scientific literature, and supported by “The National Institute of Health (NIH) in Bethesda,MD.Learning related vision problem may be new on our radar ; and as an Occupational therapist it is our duty to scrutinize new information and work in a child’s best interest.

Children with normal eyesight (20/20) can have visual problems which affect how their eyes focus, team together, or move along a line of print when reading [7]. Vision therapy is an individually prescribed program of procedures used to change and improve visual abilities. The research supports that vision therapy showed drastic improvement in perceptual capacity but also the voluntary saccade control within 3 to 8 weeks in Dyslexic children [24] [22]

Although children with reading difficulty can present numerous challenges that require co managing and concurrent therapies over a range of specialties, traditional Vision therapy techniques can be modified to meet the patient's needs where they are developmentally weak[15].[1]

Eye movement skills or visual processing skills can be trained and developed through practicing a prescribed set of activities that a child will undergo with the guidance of a trained vision therapist. At the Visual Learning Centre in Olney, MD, they suggest students supplement their in-office therapy with practice at home.

The Stickman Activityis one such exercise, designed to improve eye movement skills and visual processing skills. Working through and practicing this activity can improve the following skills:



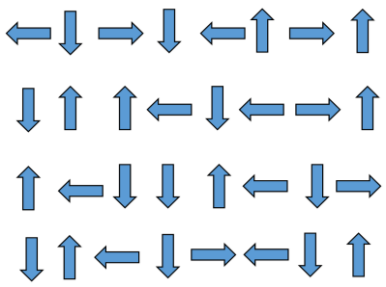
- Laterality and directionality - required for writing and recognizing orientation anddirection.

- Figure ground - required to distinguish an image relative to its background or context.

- Visual concentration - required to fixate attention long enough to complete tasks and for comprehension.

The vision therapy stickman activity is simple but effective. The person doing the activity is instructed to view a sheet that contains simple drawings of a figure wearing one glove or shoe, then say which hand is wearing the glove or which foot has a shoe on it. The goal is to first reach accuracy, and then enhance difficulty by increasing speed or including rhythm elements.

Discrimination orientation arrow activity is a vision therapy activity that develops visual discrimination, which is a skill essential in determining correct letter orientation and preventing letter reversals among children with learning-related vision problems. In this activity, students work with a sheet of paper that contains a series of arrows, which are pointing in various directions. The vision therapist asks children to look at the sheet and indicate which direction each arrow is pointing, by saying “left” or “right” while the eyes are moving across the page. We encourage children to start slowly and allow for mistakes and self-correction to build their confidence.



This activity seeks to mimic the process of selecting a direction for each letter while writing. "Should d point right or left? Should b point left or right? Which direction should I write q? Which direction should I write p?"

With practice, the outcome children enjoy is that they begin to catch their mistakes faster, reduce the frequency of errors, and dramatically boost their self-esteem. As the children improves, we incorporate a metronome into the activity and they use the beat to enhance deeper comprehension of discrimination orientation skills, until they become second nature. Soon, they will be writing b, d, q, p, etc. correctly, and with confidence.

Letter tracking activity is vision therapy letter tracking activity involves drawing a continuous line, looping and circling letters of the alphabet, in sequential order, as directed. Patients first strive for accuracy, and then progress toward greater speed while maintaining accuracy.

If the patient skips letters, he will find that the activity cannot be completed, and he can start again. This activity is useful to improve visual discrimination and reduce the errors that occur in reading, writing, and other activities due to poor visual discrimination. Letter tracking activities are designed to improve eye movement skills and visual processing skills, such as discrimination.

Eye teaming – The Brockmans activity

These types of exercises help train the Childs eyes to work together as a team to improve vision when there is symptoms like loss of place while reading, poor depth perception, headaches, difficulty concentrating and tired, red eyes.

Eye- tracking activity

Pursuits are the smooth tracking movements made for example when following a ball or a moving car. Saccades are the jumping eye movements made when reading. Both can be improved with exercises. Symptoms of a problem with eye tracking include loss of place while reading, words moving around on a page, difficulty concentrating and tired, red eyes.

The difference between Vision therapy and Occupational Therapy

Vision Therapy involves specific activities designed to improve eye movements, focusing, eye teaming, depth perception, visual-motor skills, visualization, and vision perception.

Occupational Therapy is a series of sensory-motor activities specifically designed to enhance gross and fine motor coordination, postural control, balance, equilibrium, bilateral awareness, gross motor planning, tactile awareness and tolerance, and eye-hand coordination.

Jameel Rizwana Hussaindeen, Prerana Shah et.al "**Efficacy of Vision therapy in children with learning disability and associated binocular vision anomalies"**, June 2017.

This study reports the frequency of binocular vision (BV) anomalies in children with specific learning disorders (SLD) and to assess the efficacy of vision therapy (VT) in children with a non-strabismic binocular vision anomaly (NSBVA).The study was carried out at a centre for learning disability (LD). Comprehensive eye examination and binocular vision assessment was carried out for 94 children (mean (SD) age: 15 (2.2) years) diagnosed with specific learning disorder. BV assessment was done for children with best-corrected visual acuity of ≥6/9 - N6, cooperative for examination and free from any ocular pathology. For children with a diagnosis of NSBVA (n = 46), 24 children were randomized to VT and no intervention was provided to the other 22 children who served as experimental controls. At the end of 10 sessions of vision therapy. The intervention showed significant improvement in all the BV parameters.

Dr.Garje Mona P, Dr.VishnuDhawad, Indian journal of basic and applied Medical research; "Study Of visual perceptual problems in children with learning disability"June 2015.

In this study the visual perception and visual motor integration in children diagnosed as specific learning disability (SpLD) referred for poor scholastic performance at a tertiary care hospital and to identify the different types of visual perceptual errors in the children with different subgroups of specific learning disabled

to study the effect of co-existent attention disorders (ADHD/ADD) on visual perception and visual motor integration. It was a observational prospective study in a tertiary care hospital for a duration of 1 year 6 months with 100 children, aged 8 to 14, diagnosed with specific learning disability .The Test Of Visual Perceptual Skills – 3RD Edition (TVPS), visual motor integration tests (developmental test of visual motor integration, Berry and Buktenica, 1967) and DSM 4TR criteria for ADHD/ADD was done. 78% of children had an average IQ (90-110),of these 27% had a discrepant Full Scale IQ of >15 points. Only 16% had co-existent ADHD.30% SpLD cases had only one type of learning disorder(12 dyslexics,9dysgraphics and 9 dyscalculics) whereas 71% children had an overlap type i.e. combination of dyslexia with dysgraphia or dyscalculia. Poor visual perceptual aspects contribute to classroom challenges influencing the academic proficiency. Early vision therapy can provide long term relief to affected children. This study highlights the need for acceptance and awareness of perceptual abilities and their important role in learning process and hence academic success and also strongly endorses the importance of vision therapy.

Au. Michael; Coulter, Rachel; Optometry & Visual Performance;, "Vision Therapy for the Autistic Patient: A Literature Review and Case Report" Oct 2014.

This study addresses a sampling of vision-based behaviours in ASD including visual hyper/hyposensitivity, poor facial recognition, lack of eye contact, and visual-motor integration impairments. A 10-year-old autistic male was referred for diagnosis of convergence insufficiency. There were notable developmental delays and concerns primarily regarding reading comprehension, attention deficits, and spatial organization. He previously received speech and language therapies in conjunction with occupational therapy. Diagnostic testing of the patient's ocular motility yielded

tracking inefficiencies and poor accuracy. The Wachs Analysis of Cognitive Structures (WACS) evaluation was performed and revealed weaknesses in a number of visualization tasks as well as in gross and fine motor coordination. An individualized program of vision therapy was recommended to improve his visualization, tracking, and visual motor integration abilities. This case report illustrates how the distinctive challenges of structuring a successful vision therapy program for the varying presentations of ASD can be met by adapting techniques to the appropriate developmental stage of the child. Thus Vision therapy provides the framework to build skills that are transferrable and valuable in the classroom.

Giseli Donadon Germano et.al "Visual Motor perception of the students with attention deficit hyperactivity disorders", 2013.

This study isto characterize and compare the visual motor perception of students with good academic performance in 40 male students from 2nd to 5th grade, aged between 10 years and 8 months old participated in the study. They divided into two groups, paired according to the age, schooling and gender. The students were submitted to the developmental test of Visual perception (DTVR2,) they conducted that student with ADHD presented inferior performance in Visuo motor perception when compared to students with good academic performance. Students with ADHD in this study presented inferior performance in visuomotor skills when compared to students with good academic performance. The study proved that phenomenon of inattention directly interfered in their visual motor performance.

Vijayalaxmi V. Mogassale.Vishwanath D. Patil et.al. "Prevalence of specific Learning Disabilities among Primary School Children in a South Indian Study."December 2011.

This study measures the prevalence of specific learning disabilities (SpLDs) such as dyslexia, dysgraphia and dyscalculia among primary school children in a South Indian city. Methods a cross-sectional multi-staged stratified randomized cluster sampling study was conducted among children aged 8–11 years from third and fourth standard. A six level screening approach that commenced with identification of scholastic backwardness followed by stepwise exclusion of impaired vision and hearing, chronic medical conditions and subnormal intelligence was carried out among these children. In the final step, the remaining children were subjected to specific tests for reading, comprehension, writing and mathematical calculation. This study suggests that the prevalence of Specific learning disabilities is at the higher side of previous estimations in India. The study is unique due to its large geographically representative design.

ReepaSanghavi MOT student and RajniKelkarMOT, The Indian Journal of Occupational Therapy:**"Visual Motor Integration and learning disabled Children''** (August - November, 05)

To study and compare the performance of normal and learning disabilities on Beery and Buktenicas development test of Visual Motor Integration, To provide Occupational therapy intervention for improving VMI in the learning disabled children and observe the effectiveness of therapy. Three groups were assessed on DVMI. Normal children (n-80) were assessed in groups. Experimental group and control group, each consisting of 16 learning disabled children were assessed

individually. Experimental group was given occupational therapy intervention in the department and supplementary therapy by parents, guided by therapist, regularly for 12 weeks. Occupational Therapy intervention included ergonomic factors, gross and fine motor activities. Control group was given counsellingabout OT program for 12 weeks. Post therapy, patients were re-assessed on DVMI and raw scores obtained were analyzed in order to examine the efficacy of Occupational Therapy program. Thus Occupational therapy has wide scope in treating learning – disabled children with the help of Occupational therapy program.

N.BonillaWarford; Allison. Christine "Journal of optometric Vision "A Review of the efficacy of oculomotor Vision therapy in improving reading skills." 2004.

Vision therapy has been used for years by optometrist to improve the oculomotor skills in children struggling with reading .The vast majority of studies shows a weak but positive relationship between oculomotor Vision therapy and improved reading skills such as reading rate and comprehension. The evidence as a whole shows that this improvement is equivalent to that of conventional reading therapy but that the most improvement exist when both vision therapy and reading training are used with the patient. Eleven studies from 1940 to 2001 were evaluated and compared. This study endorses the use of vision therapy with patients with non-specific reading disabilities.

Maples W.C. "Visual factors that significantly impact academic performance."Optometry, 2003.

This study was undertaken to discover the visual skills that were significantly correlated with academic performance problems. A total of 2,659 examinations on 540 children were administered over three consecutive school years. Socio-economic,

racial and standardized academic performance data (Iowa Test of Basic Skills – ITBS) were furnished by the families and the school system. The visual and demographic data from the examinations were then compared to performance on the 21 subtests of the ITBS. Visual factors are significantly better predictors of academic success as measured by the ITBS than is race or socio-economics. Visual motor activities are better predictors of ITBS scores than are binocularity or accommodation.

Jennifer Mazzola Sortor, OD, MS and Marjean Taylor Kulp, OD, MS, FAAO, "The Results of the Beery–Buktenica Developmental Test of Visual – Motor Integration and Its subtests related to achievement test scores." November 2003

Although visual analysis, motor coordination, and visual – motor integration can be each affect performance on a test of visual motor integration, previous studies have not reported the relative importance of these components to the relation between visual motor integration and learning readiness, reading and math. This investigation relates to academic achievement in reading and math to performance on the Beery – Buktenica Developmental Test of Visual – Motor Integration and its subtest, Visual perception and Motor coordination. The VMI was administered to 155 children in second through fourth grades (7 to 10 years of age).A significant difference was found in performance on the VMI and visual perception and motor coordination subtests between children in upper and lower quartiles in reading and math achievement. Visual Motor integration and its subtest showed a significant relation between the visual perception and math achievement. Visual motor integration should be assessed in children with poor math / or reading achievement.(optom Vis Sci 2003)

Heather L. Dankert et al. "Occupational therapy effect on visuomotor skills in preschool children ''American Journal of Occupational therapy, September – October 2003

The purpose of this study was to evaluate the assumption that preschool children who receive Occupational therapy will demonstrate significant improvement in their Visual – Motor Integration (VMI) and the two supplemental Visual Perception and Motor Coordination tests.Preschool children with developmental delays (n=12) received Occupational therapy,30 minute per session for 1 full year. Their performance was compared to that of two control groups; preschool students without disabilities (n=15) who received no occupational therapy. The VMIand two supplemental tests were administered three times to each student, at the beginning, middle, and end of school year. The study found that occupational therapy is beneficial to preschool children with visual motor skill delay.

Fischer, Hartnegg, Klaus. Effects of visual training on saccade control in dyslexia.Perception 29: 531-542, 2000.

This study reports the effects of daily practice of three visual tasks on the saccadic performance of the 85 dyslexic children in the age range of 8 to 15 years. The children were selected from among other dyslexics because they showed deficits in their eye-movement control, especially in fixation stability and/or voluntary saccade control. The eye movements were measured in an overlap pro-saccade and a gap anti-saccade task before and after the training. The three tasks used for the training included a fixation, a saccade, and a distractor condition. In any of these tasks, the subject had to detect the last orientation of a small pattern, which rapidly changed its orientation between up, down, right, and left, before it disappeared after

some time. The task was to press one of four keys corresponding to the last orientation. The results indicate that daily practice improved not only the perceptual capacity, but also the voluntary saccade control, within 3 to 8 weeks. After the vision therapy training, the group of dyslexics was no longer statistically different from the control group.

Burkhart Fischer, Klaus Hartnegg, "Effect of Vision therapy on saccade control in dyslexia." **February 2000**

This study reports the effects of daily practice of three visual tasks on the saccadic performance of 85 dyslexic children in the age range of 8 to 15 years. The children were selected from among other dyslexics because they showed deficits in their eye-movement control, especially in fixation stability and/or voluntary saccade control. Their eye movements were measured in an overlap prosaccade and a gap antisaccade task before and after the training. The three tasks used for the training included a fixation, a saccade, and a distractor condition. In any of these tasks, the subject had to detect the last orientation of a small pattern, which rapidly changed its orientation between up, down, right, and left, before it disappeared after some time. The task was to press one of four keys corresponding to the last orientation. The visual pattern was presented on an LCD display of a small hand-held instrument given to the children for daily use at home. The results indicate that daily practice improved not only the perceptual capacity, but also the voluntary saccade control, within 3 to 8 weeks. After the vision therapy, the group of dyslexics was no longer statistically different from the control group.

Catherine Boden and Darlene A. Broadeur. Journal of Learning Disabilities "Visual Processing of verbal and Nonverbal Stimuli in Adolescents with Reading Disabilities."January / February 1999.

This study investigated whether a group of children with reading disabilities (RD) were slower at processing visual information in general (compared to a group of children of comparable reading level), or whether their deficit was specific to the written word. Computerized backward masking and temporal integration tasks were used to assess the speed of visual information processing. Stimulus complexity and type were varied, creating a 2 x 2 matrix of stimulus conditions: simple nonverbal, complex nonverbal simple, verbal and nonverbal visual stimuli,although the effect was magnified when they were processing verbal stimuli. Thus, the results of this study suggest that some youth with reading disabilities have visual temporal processing deficits that compared difficulties in processing verbal information during reading.

Taylor Kulp M."Relationship between visual motor integration skill and academic performance in kindergarten through third grade." Optometry and Vision Science, 1999.

The objective of this study was to examine the relationship between visual motor integration skill and academic performance in kindergarten through third grade. One hundred ninety-one (n = 191) children in kindergarten through third grade (mean age = 7.78 years; 52% male) from an upper-middle class, suburban primarily Caucasian, elementary school near Cleveland, Ohio were included in this investigation. Visual analysis and visual motor integration skill were assessed with the Beery Developmental Test of Visual Motor Integration (VMI) long form. The

relationship between performance on the VMI and teachers' ratings of academic achievement was analyzed. The children's regular classroom teachers rated the children with respect to reading, math, and writing ability. Second and third grade children (N = 98) were also rated on spelling ability. An analysis by age group revealed that performance on the VMI was significantly correlated with reading achievement ratings in the 7- 8- and 9- year- olds. This analysis again revealed a significant correlation between the VMI and teachers' achievement ratings in math. Performance on a visual analysis and visual motor integration task is significantly related to academic performance in 7- 8- and 9- year olds.

Eden G, Stein J, Wood M, Wood F. "Verbal and visual problems in reading disability." Journal of Learning Disabilities 1995.

In a preliminary study (Eden, Stein & Wood 1993), we showed that visuospatial and oculomotor tests can be used to differentiate children with reading disabilities from non - disabled children. In the present study, we investigated a larger sample of children to see if these findings held true. Using 93 children from the Bowman Gray Learning Disability Project (mean age = 11.3 years: 54 boys, 39 girls), we compared the phonological and visuospatial abilities of non-disabled children (children whose reading at fifth grade rated a Woodcock-Johnson reading standardized score between 85 and 115), and children with reading disability (whose reading standardized score was below 85 on the Woodcock-Johnson). In addition to performing poorly on verbal tests, the children with reading disability were significantly worse than non-disabled children at many visual and eye- movement tasks. A high proportion of the variance (68%) in reading ability of both the non-disabled children and those with reading disability could be predicted by combining

visual and phonological scores in a multiple regression. These results provide further support for the hypothesis that reading disability may, to some extent, result from dysfunction of the visual and oculomotor systems.

Sigler G, Wylie T. "The effect of vision therapy on reading rate", A pilot study– .Journal of Behavioural Optometry, 1994.

Three subjects, two aged 8 and one age 10, with identified visual system disorders were selected as subjects to evaluate the effects of vision therapy on reading efficiency as measured by reading rate. Reading rate measures were taken prior to initiation, at the conclusion, and 90 days post-visual therapy. The results were that all subjects had accelerated reading rate gains during the period of vision therapy and that the reading rates for two of the three subjects continued to increase in the post-therapy (maintenance) period. All three subjects experienced positive gains over the period (180 days) of the study. Thus this study proves that vision therapy has significant effect when used as intervention for learning disabled children.

Stephen T. Demers and Dan Wright, "Comparison of scores on two Visual – Motor tests for Children referred for learning or adjustment difficulties", **1981.**

In this study 93 students 6to 11 yr. old and referred for evaluation because of learning or adjustmentDifficulties by their classroom teachers were ad- ministered Beery's Developmental Test of Visual-motor integration and Kop- pitz's version of the Bender-Gestalt test. Previous research with retarded samples indicated the two tests were highly correlated while one study using normal subjects yielded significant differences between the tests. The present study indicated significant mean differences between the tests but moderate correlations between the measures for each of three age ranges between 6 and 11 yr. In general, Beery's test gave higher standard

scores for this sample of referred students; examiners arecautioned not to use the tests interchangeably with similar populations.

Donald D. Hammill, James E. Leigh et.al,"A New Definition of Learning Disabilities" February 1987

Learning disabilities is a generic term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic tothe individual and presumed to be due to central nervous system dysfunction. Eventhough a learning disability may occur concomitantly with other handicapping conditions (e.g., sensory impairment, mental retardation, social and emotional disturbance) or environmental influences, it is not the direct result of those conditions or influences. The preceding has been a discussion of why and how the NJCLD came to propose a new definition of learning disabilities.

Kenneth kavale, PhD. Journal of Learning Disabilities, "Meta-Analysis of the Relationship between Visual Perceptual Skills and Reading Achievement,"1982

A review of research examines the relationship between visual perceptual skills and reading achievement using meta-analysis to integrate statistically the results from 161 studies. A total of 1,571 correlation coefficients were collected and aggregated across eight visual perceptual skills, six reading abilities, three grade levels, and three subject groups. Additionally, a correlation matrix was constructed and used for a factor analysis, canonical correlation analysis, and step-wise multiple regression analysis descriptive of the relationship among and between visual perceptual skills, intelligence, and reading achievement variables. The findings suggested that visual perception is an important correlate of reading achievement, but

the proportion of explained variance in reading skills was contingent on the combination of visual and reading variables considered. It was concluded that visual perceptual skills should be included in the complex of factors predictive of reading achievement.

Alice E. Klein, "The Validity of the Beery Test of Visual Motor integration in predicting achievement in kindergarten, first, and second grades". Educational and psychological measurement 1978

Using three samples of prekindergarten pupils from three successive years in large Midwest school district assessed the ability of the visual – Motor Integration Test (VMI) to predict academic achievement. At the beginning of the kindergarten year, the screening test of Academic Readiness (STAR) was administered to all three samples. Obtained VMI – STAR correlations ranged from .102 to .592.At the beginning of the first grade, the Stanford Early School Achievement Test (SAT), Primary Battery I, was administered to one sample of pupil. The VMI – SAT correlations ranged from .251 to .402.All of the 61 correlations were statistically significant. The VMI appeared to be most predictive of the STAR Total and Numbers scores. SESATMathematics and word reading scores and SAT Total Mathematics scores. Test – retest reliability, obtained on one sample over a time period of seven months, was 630.

METHODOLOGY

Research design

- Quasi experimental design.

Control group (pre test) OT Intervention Post test

Experimental group (Pre test) OT Intervention + Vision Therapy Post test

Sample

- 15 subjects for control group.
- 15 subjects for experimental group.

Duration of the Study

- Duration of the study was one year with 3 months intervention.

Sampling Technique

- Convenient sampling technique was adopted.

Location of Study

- National Institute of Mental health and Neurosciences (NIMHANS) Bangalore - Karnataka

Variables Under the study

- **Independent Variable**

  Vision Therapy

- **Dependent Variable**

  VisuoMotor skills of learning disability.

- **Screening Criteria**

Inclusion Criteria

- Children between age 7 to 10 years
- Children of both genders
- Children diagnosed as learning disabled by qualified professional
- Learning disabled with Attention deficit hyperactive disorder
- Children with poor visual motor skills

Exclusion Criteria

- Learning disabled with hearing impairment.
- Age below 7 years and above 10 years.
- Children with diagnosis of cerebral palsy, Mental Retardation, Autism, neuromusculardisorder, musculoskeletal disorder wereexcluded from groups.

Outcome measure

The standardized assessment tool used as outcome measure at baseline i.e pre and at post intervention.

Beery - Buktenica Developmental test of Visual Motor Integration assessment (Keith E. Beery PhD and Norman A. Buktenica, et .al)

Description of tool

The Beery - Buktenica developmental test of Visuomotor integration ,5th edition (VMI) is a structured measure of visual - perception and motor abilities for individual between age 2 - 18years (Beery & Beery 2004).

The VMI - V is described as being culturally fair and consists of 30 developmentally sequenced geometric form and can be administered in a group or individually taking approximately 10 to 15 minutes to complete.

The VMI - V mean split half internal consistency reliability co efficient was 0.88 across all age and it has a test - retest average reliability of 0.89.The Beery VMI is suitable for respondent with diverse environmental educational and linguistic background[13]

Materials Used

- Scrap of paper
- Ball
- Pencil
- Table
- Chair
- Stopwatch

Procedure of collection of data

Convenient sampling of 30 subjects were selected for the study. The subjects were selected from the age group between 7 to 10 years. The pre data was collected from both groups before the intervention phase using Beery Visual - Motor integration scale. Then the 30 subjects were divided into two groups, a control and an experimental group. In both control and experimental group consisting of 15 subjects each.

The control group was children who received regular occupational therapy session in the department where as the experimental group received vision therapy along with Occupational therapy sessions.

The therapy was given for 3 months duration consisting of 36 sessions. In which one session was extended up to 45 minutes duration, total 3 sessions per week and monthly 12 sessions were given.

The Beery VMI scale is used to assess the visuomotor skills in learning disabled children. Post data were collected after treatment sessions by same scale (VMI).During the intervention phase, the children were engaged in vision therapy activities for 45 minutes timed by therapist. After this intervention data were tabulated and felt with statistically treated with‘t’ test.

Experimental Group activities (Vision therapy and Occupational therapy activities)

It takes place with three phase’s Motor phase, Oculomotor phase and Visualisation phase.Each session was carried out for 45 minutes as follows.

Vision therapy activities:

Discrimination Orientation Arrows (DOA)

The stickman activity

Visual discrimination activity

The letter tracking activity

Eye tracking activity

Eye teaming activity

Motor phase

- Jump in on the trampoline and catching the ball
- Walking on the beam

- Rhythmic movements
- Duck walking
- Pigeon toe walking

Oculomotor phase

- Convergence and divergence skills
- Eye catch activity
- Simultaneous perception
- focussing activities

Visualisation phase

- What is the order of the picture
- Picture talk on the board

Activity	**Description**
Angels in the snow	Start lying on the ground. Tap a limb and child moves indicated limb. Progress to homolateral and then contralateral movements. Brushing limbs against the floor allows the child to feel their different body parts.
Walking rail	Begin with tape on the ground. Walk along the line and observe posture and approach. Progress to rail and look for child's awareness of the midline. Eventually walk heel to toe forward before backward. Can also attempt crossover of feet and using flashlights to point at feet.
Chalkboard circles	Chalk in each hand. The child draws circles moving in the same direction then opposite direction.
Balance board	Balance on top of the board with support before allowing child to attempt by himself. Touch specified parts of the board to the floor (left, right, front, or back). Track a moving target without falling.
Robot directionality	child directs therapist towards a location or the performance of a task.

Body map	Draw a life-size representation of the child. Add in as many body parts as possible. Patient identifies different body parts on himself and then on the drawing. Ask about the function of those body parts. Identify body parts on therapist who is standing next to patient and then across from child. Identify body parts on people in magazines.
Marsden ball	Start with lying on the floor and have the child track the ball swinging side-to-side or in a circular motion. Eventually incorporate motor and spatial aspects of catching and bunting.
Flashlight tag	One flashlight is for the therapist, one for the child. Follow the therapist's light. Can include making loops, figure 8s, or letters.
Rolling ball	Lower level activity. From a seated position, roll a ball towards the child and have them track across the distance. Maintain a slow enough speed to allow for a pursuit. Cross the midline with the rolls and ask the patient to Catch and roll the ball back.
Multi-matrix	Coloured blocks with numbers/letters on them. child arranges them in order or according to a pattern. Introduce loose prism to promote convergence training as well.
Sorting cards	Sort playing cards by suit or number.
Space fixator	Change child's fixation from one target on the fixator to another. Have the child point to the indicated targets. Incorporate bilateral coordination with different hands used and simultaneous movements with feet.

TRAINING SESSIONS

Experimental Group

1 session - 45minutes

Weekly - 3 sessions

Monthly - 12 sessions

Total - 36 sessions

Sessions	Duration	Vision therapy activities
1 - 3	1 month /1st week / 2:15hrs	• **Motor Phase** Jump in on the trampoline while catch the ball Walking on the beam Rhythmic movements Duck walking Pigeon toe walking • **The Stickman Activity**
4 - 6	1 month / 2nd week / 4.30hrs	• **Oculomotor phase** Convergence and divergence skills Eye catch activity Simultaneous perception focussing activities • **Discrimination orientation Arrow activity**
7-9	1 month / 3rd week / 6.45hrs	• Visualisation phase • Eye tracking • Eye teaming
10 - 12	1month / 4th week / 9:0 hrs	• Angel in the snow • Walking rail

13 - 15	2nd month / 5th week / 11:15 hrs	1 Chalk board circles 2 Balance board
16 - 18	2nd month / 6th week / 13:30 hrs	1 Robot directionality 2 Body map
19 - 21	2nd month / 7th week / 15:45 hrs	1 Marshden ball
22 - 24	2nd month / 8th week / 18:00 hrs	1 Flash tag
25 - 27	3rd month / 9th week / 20:15 hrs	1 Rolling ball
28 - 30	3rd month / 10th week / 22:30 hrs	1 Multimatrix
31 - 33	3rd month / 11th week / 24:45 hrs	Sorting cards
34 - 36	3rd month / 12th week / 27: 00 hrs	Space fixator


CHHOTA

CONTROL GROUP: DATA TABLE

S.No.	Age	Raw Score	
		Pre-Test	Post-test
1	7.2	12	13
2	7.0	13	13
3	8.3	13	16
4	10	10	11
5	9.5	13	12
6	7.8	14	14
7	7	12	15
8	9.4	17	17
9	9	11	12
10	10	12	13
11	8.9	10	10
12	8	13	13
13	7.6	13	13
14	7.6	19	11
15	10	12	13

EXPERIMENTAL GROUP:DATA TABLE

S.No	Age	Raw Score	
		Pre-Test	Post-test
1	9	12	15
2	7.5	13	14
3	8.6	13	16
4	7.1	10	13
5	8.3	13	16
6	10	14	15
7	9.3	14	17
8	7.4	12	13
9	7.8	10	13
10	9.4	13	15
11	8.7	13	17
12	7.2	10	12
13	8	12	14
14	10	17	19
15	9.5	12	15

Table: 1COMPARISON OF VISUO-MOTOR SKILLS OFPRE TEST OF BOTH CONTROL AND EXPERIMENTAL GROUP

S. No	Visuomotor-motor Skills	Mean	SD	"t" value	Degree of freedom	"p" value
1	Pre-test of Control group	12.93	2.37	0.5192	28	P > 0.05
2	Pre-test of Experimental group	12.53	1.81			

The independent t test is used to compare the data of both groups.The Control group pre-test mean value is 12.93 and Experimental group pre-test mean value is 12.53 and t value is 0.5192 ($p > 0.05$).Hence,there is no significant difference between the groups for pre-test scores for visuomotor skills.

Graph: 1 COMPARISON OF VISUO-MOTOR SKILLS OF PRE TEST OF BOTH CONTROL GROUP AND EXPERIMENTAL GROUP

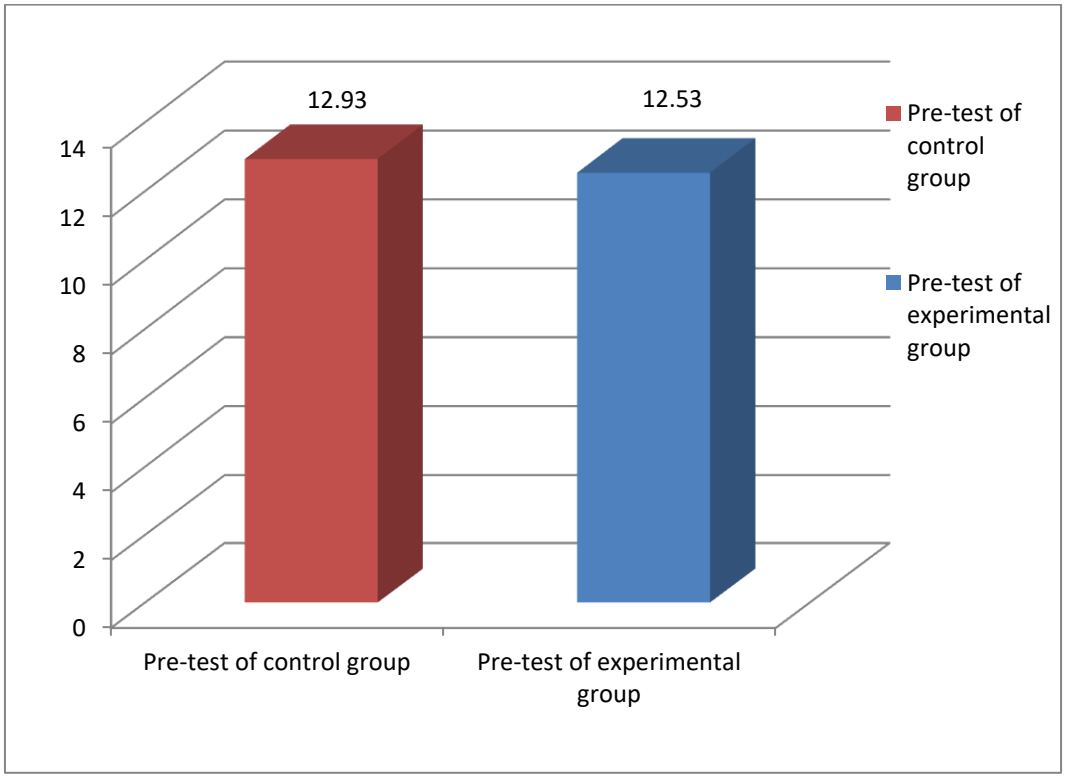


Table 2: COMPARISION OF VISUO-MOTOR SKILLS BETWEEN PRE AND POST TEST OF CONTROL GROUP

S. No	Visuomotor skills	Mean	SD	"t" value	Degree of freedom	"p" value
1	Pre-test of Control group	12.93	2.37	0.2063	14	P > 0.05
2	Post-test of Experimental group	13.07	1.87			

Table 2, shows the Control group comparison between pre-test and post test for visuomotor skills.The paired t test is used to compute the data of both Control group.The Control group pre-test mean value 12.93 and post test mean value is 13.07. The't' value is 0.2063, ($p > 0.05$) Hence,there is no significant difference between the pre-test and post test of the Control group for visuomotor skills.

Graph:2 COMPARISION OF VISUO-MOTOR SKILLS BETWEEN PRE AND POST TEST OF CONTROL GROUP

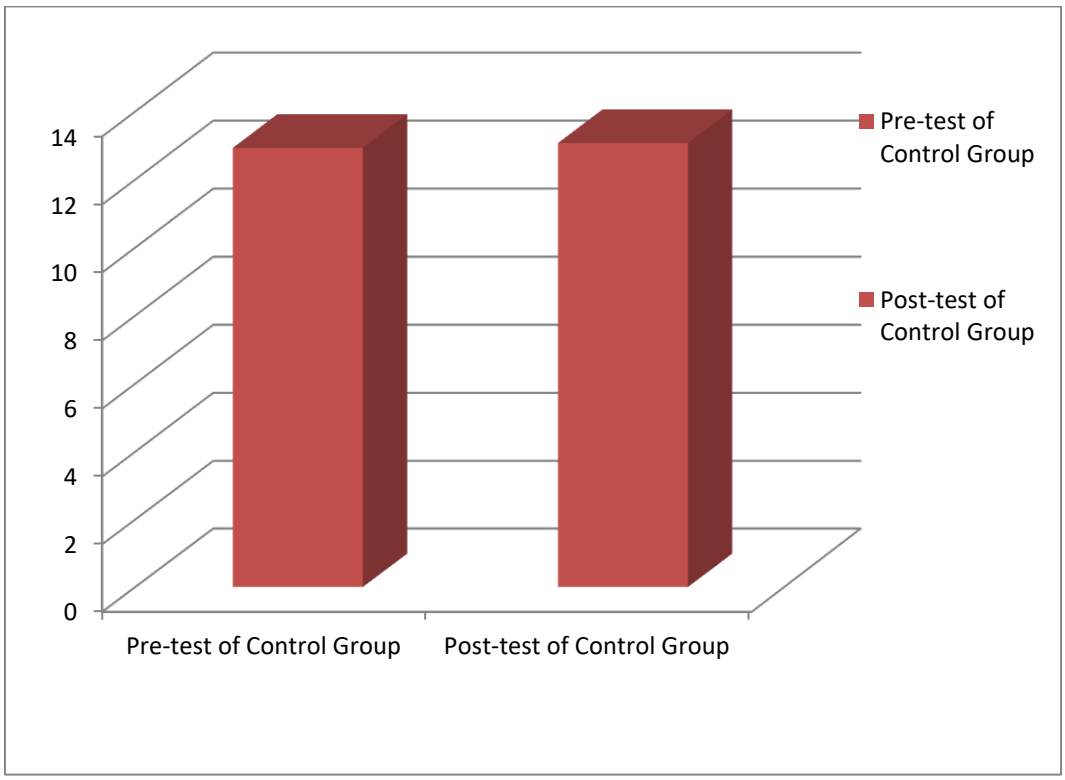


Table: 3 COMPARISON OF VISUOMOTOR SKILLS BETWEEN PRE AND POST TEST OF EXPERIMENTAL GROUP

S. No	Visuomotor skills	Mean	SD	"t" value	Degree of freedom	"p" value
1	Pre-test Control group	12.53	1.81	10.2116	14	P < 0.05
2	Post-test Experimental group	14.93	1.87			

Table 3, shows the Experimental group comparison between pre-test and post test for visuomotor skills.The paired t test is used to compare the data of both the Experimental groups.The experimental group pre-test mean value 12.53 and post test mean value 14.93 and t value is 10.2116 , ($p< 0.05$).Hence, there is high significant difference between the pre-test and post test of Experimental group for visuomotor skills.

Graph: 3 COMPARISON OF VISUOMOTOR SKILLS BETWEEN PRE ANDPOST TEST OF EXPERIMENTAL GROUP

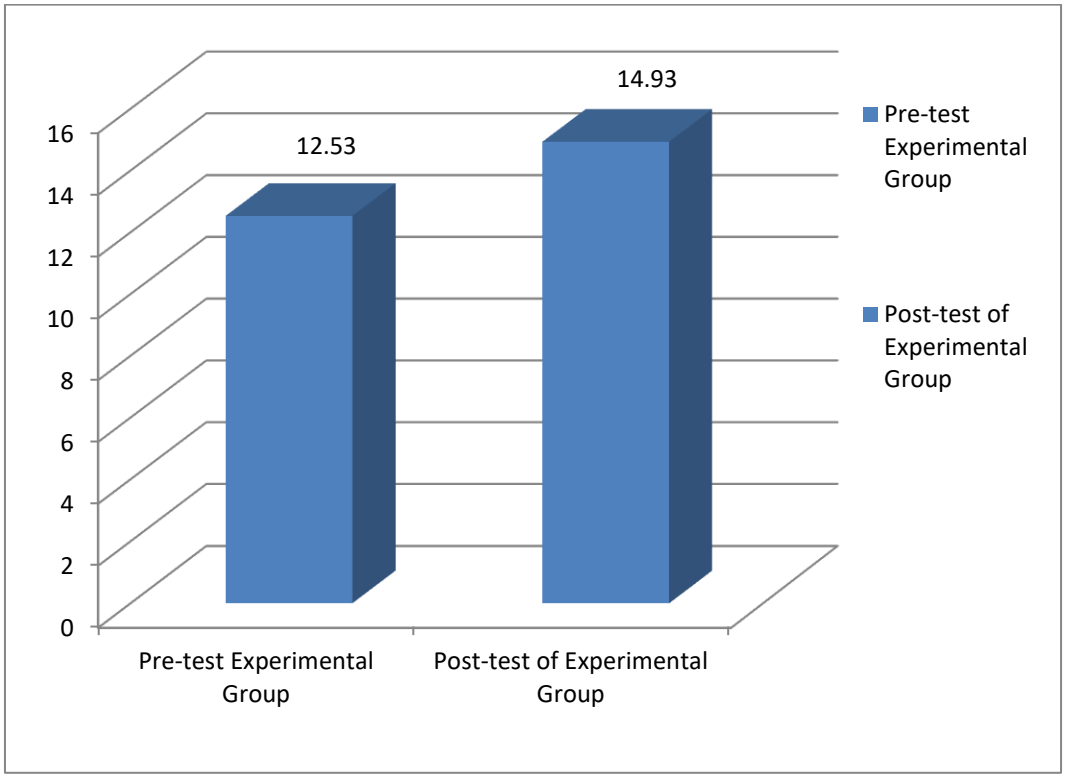
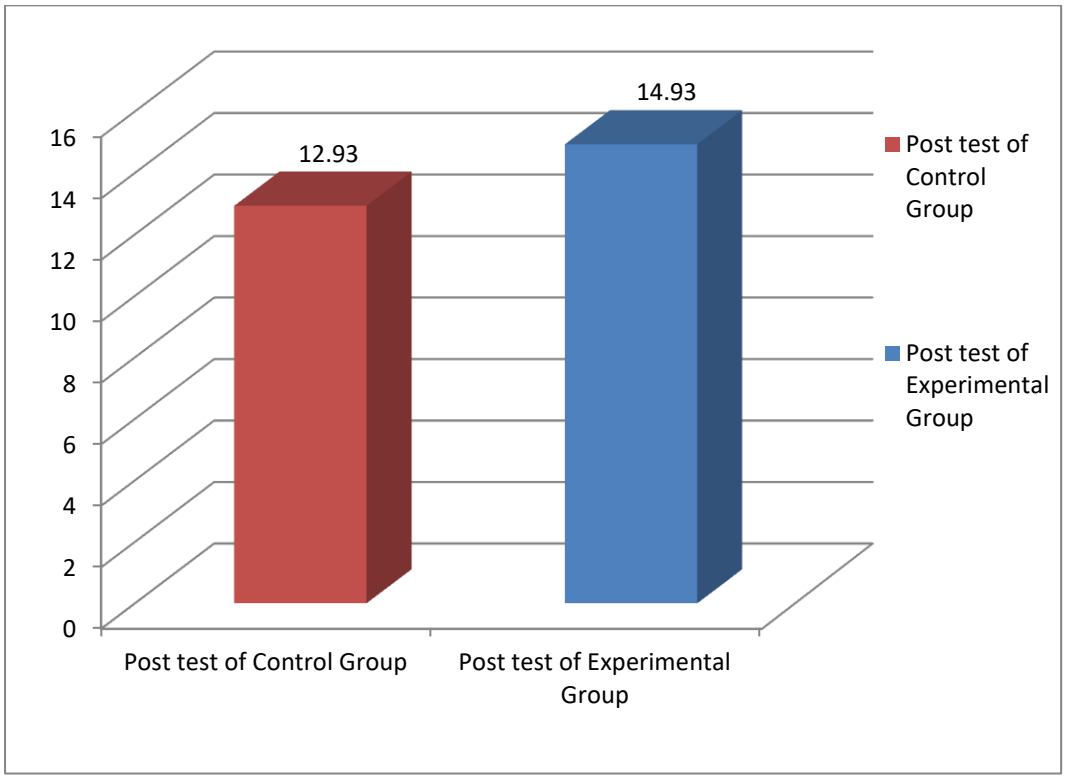


Table: 4 COMPARISON OF VISUOMOTOR SKILLS OF POST TEST OF BOTH CONTROL AND EXPERIMENTAL GROUP

S. No	Visuomotor skills	Mean	SD	"t" value	Degree of freedom	"p" value
1	Post test of Control Group	12.93	2.37	2.5631	28	P < 0.05
2	Post test of Experimental Group	14.93	1.84			

Table 4, shows the comparison between post test scores of Control group and Experimental group for visuomotor skills. The independent t test is used to compute the data of the post test of control and experimental groups.The control group post mean value is 12.93 and experimental group post test mean is 14.93 and t value is 2.5631 , ($p< 0.05$).Hence,there is statistical significant difference between the post test of Control and Experimental groups for visuomotor skills.

Graph: 4 COMPARISON OF VISUOMOTOR SKILLS OF POST TEST OFBOTH CONTROL AND EXPERIMENTAL GROUP



DISCUSSION

Vision therapy is an individually prescribed program of procedures used to change and improve visual abilities. Improvement in visual function enables the child to become more effective learner. These learning related vision problems cause children to struggle unnecessarily, and this can result in their being mislabled as learning disabled. Vision therapy has been shown to improve control of eye movements during visuo motor activities and reading. The goal of Vision therapy is to restore as much improvement in visuo motor skills in learning disabled children. An individualized program of vision therapy was recommended to improve his visualisation, tracking, and visual motor integration abilities. **"Vision therapy for the Autistic Patient: A literature Review and case Report."**[15]The question of whether or not Vision Therapy actually improves reading rate gain during the period of vision therapy is stated in the study **"The Effect of Vision therapy on reading rate"**[38]

In this study results proved that Vision therapy has beneficial effect in improving visuo motor skills in learning disabled children , and occupational therapy has also beneficial effect in improving visuo motor skills. However the study results revealed that Vision therapy when used in combination with conventional occupational therapy is more beneficial in improving visuo motor skills in learning disabled children.

The result of this study showed that the experimental group improved better than the control group as seen in table - 1. Both experimental and control group showed significant improvement in post assessment as seen in table 3 and 4. The control group received occupational therapy where as the experimental group received occupational therapy combined with vision therapy.

Analysis of pre test and post test scores of VMI test showed significant improvement in visuo motor skills as seen in graph 1 and 2. However the pre - test and post - test scores of the experimental group was higher than that of the control group. The reason for improvement in experimental group got from the 12 sessions in a month for 3 months, of Vision therapy and the findings of the study are consistent with other studies in which vision therapy was used in rehabilitation of learning disabled children.[15, 29]

The comparison of pre-test visuo motor skills for both Control and Experimental group (Table 1 and Graph 1) shows the mean score of 12.93 (control) and 12.53 (experimental) respectively. The independent 't' test value was obtained to be 0.5192 and ($p > 0.05$).Hence there is no significant difference in the mean values for the visuo motor skills in both groups.

The comparison of visuo motor skills for Control group pre-test and post-test(Table 2,Graph 2) shows the mean scores of 12.93 and 13.07 and paired 't' test value was obtained to be 0.2063 and ($p > 0.05$).Hence there is no significant difference in the mean values for the visuo motor skills in Control group for pre-test and post test.

The comparison of visuo motor skills for Experimental group pre-test and post-test (Table 3 and Graph 3) shows the mean scores of 12.53 and 14.93 .The 't' value was obtained to be 10.2116 and ($p < 0.05$). So there is high significant difference between pre and post test values. The reason for improvement in experimental group can be due to vision therapy in adjunct to occupational therapy.

The comparison of post test visuo motor skills for both Experimental group ad Control group (Table 4 and Graph 4) shows that mean scores 12.93 (Control) and

14.93 (Experimental group) respectively. Independent 't' test value is found to be 2.5631 and ($p < 0.05$).When the performance of two groups was compared ,the 't' and p value being statistically significant supports the fact that improvement in experimental group was more than that in control .

The occupational therapy and vision therapy have facilitated the improvement of Visual motor integration, which also can explain the better improvement in experimental group as compared with the control group.

The present study espoused the tremendous progress and impact that vision therapy can have on the quality of life in children with learning disability. The study suggests the specificity of activity program, duration and intensity of both Occupational therapy and Vision therapy. The activities were graded from simple to complex activities.

In this study the activities were selected in such a way as to encourage the child to develop the visuo motor skills. The children improved both objectively and subjectively in their visual attention, tracking and visual perception. The findings suggest that providing stimulation through activities can encourage the child to improve visuo motor skills.

Treatment was based on visuo motor Integration, Eye hand co- ordination and ergonomic factors as stated in,"Visual Motor Integration and learning disabled Children, ReepaSanghavi MOT student and," The Indian Journal of Occupational Therapy;2005.[35]

The experimental group was provided Vision Therapy along with Occupational therapy .Vision therapy is type of eye training. In learning disability brain is affected by ability to sound out letters, not the ability to see them. **"Students with visual**

tracking problems will lose their place when reading, skip and re read words and has more difficulty copying from one place to another. Students with focusing and eye teaming problems may experience visual fatigue when reading, slower reading speed and reduced reading comprehension." - Dr.Robert Sanet.

The result of this study showed that Experimental group improved better than the control group. While both experimental and control group showed significant improvement in visuo motor skills, implying that Occupational therapy and Vision therapy individually have beneficial effect in improving visuo motor skills. It also implies that both conventional Occupational Therapy and Vision therapy when used in combination have much better effect and are more beneficial in improving the visuo motor skills.

Hence this study proves the alternative hypothesis that Vision Therapy when used in Combination with Occupational therapy has better beneficial effect in improving visuo motor skills. A robust occupational therapy program and vision therapy is integral in definitive management. Studies have undisputed shown that these when incorporated in developmental therapies of learning disabled children are often valuable.[(2)]The ultimate goal of assessing visual motor skills is its role in remediation. So, the null hypothesis can be rejected.

Clinical Implications

The Vision therapy may contribute toward the improvement of visuo motor Skills in learning disabled Children. The study would confirm the effectiveness of Vision. Therapy when used alongside Occupational therapy. Assessment of Visuo motor skills is essential in evaluation of learning disabled children. Occupational therapy and Vision therapy would be beneficial in these affected children.[27]

CONCLUSION

From this study, it is concluded that there is significant improvement in visuomotor skills of the children with learning disability through the vision therapy.

The result of this study indicates that children with learning disability who had vision therapy and occupational therapy Intervention showed more improvement than who had only Occupational therapy intervention.

"Combining vision therapy with Occupational therapy seems to dramatically enhance the benefits of both therapeutic treatment programs in children with attention problem especially learning disabled" stated Applebaum. "Many parents have reported positive results with this approach, particularly if Occupational and vision therapy is done on intensive basis."

LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS OF THE STUDY

- The study was done on small sample size
- Study was conducted for shorter duration
- Outsized age group (7-10) participated in this study

RECOMMENDATIONS

- The study can be done on a larger sample size.
- Study can be extended to other age groups.
- The study can be done by more precisely using developmental selection of Visuomotor activities.

BIBLIOGRAPHY

Books

1. Care of patients with learning related vision problem ; St.Louis;American optometric association.
2. Physical and Occupational Therapy in Paediatrics. A quarterly Journal of developmental theory.
3. Paediatrics Occupational Therapy - Handbook. On learning disabilities by Integra.
4. Teaching students with reading disabilities ; A guide for professionals
5. Occupational therapyfor children – Pat NusePratt,M.O.T.,O,T,R,L.,F.A.O.T.A; Anne Stevens Allen,M.A.,O.T.R; 2nd edition.
6. Understanding and Managing Vision deficits.A guide for Occupational therapist - Mitchell Schtiman, 2nd Edition.
7. A Summary of research an clinical studies on vision and learning supporting students with Learning disability ;A guide for teachers ;Ministry of Education.
8. Supporting students with learning disabilities ; guide to teachers (Learning : A to Z) Ministry of education.
9. Occupational Therapy and people with learning disabilities .Allison lilywhite and Davidson Haines.
10. Occupational therapy and people with learning disabilities – Alison Lillywhite and David Haines.

Journals

11. Goss, David A.; Downing, et.al., “The Effect of HTS Vision Therapy”, Conducted in a School Setting on Reading Skills in Third and Fourth Grade Students, 1987.

12. Heather L.Dankert et al “Occupational therapy effect on visuomotor skills in preschool children” (2003).

13. A study of “Children with Learning disability and sensorimotor problems”,Physical and Occupational therapy paediatrics, 1989.

14. Alice E. Klein,“The Validity of the Beery Test of Visual Motor integration in predicting achievement in kindergarten”, first, and second grades”. Educational and psychological measurement, 1978.

15. Au.Michael; Coulter, Rachel; “Vision Therapy for the Autistic Patient”: A Literature Review and Case Report, October 2014; Optometry & Visual Performance; Oct2014, Vol. 2 Issue 5, p244.

16. Boden C, Brodeur D. “Visual processing of verbal and nonverbal stimuli in adolescents with reading disabilities”. Journal of Learning Disabilities 32 (1): 58-71, 1999.

17. Bonilla-Warford N, Allison C. “A review of the efficacy of oculomotor vision therapy in improving reading Skills”. J Optom Vis Dev. 2004; 35(2):108–115.

18. Bowan M. Learning disabilities, dyslexia, and vision: a subject review: “A rebuttal, literature review and commentary”. Optometry 73 (9): 553-575, 2002.

19. Donald D. Hammill, James E. et al. “A New Definition of learning Disabilities”.

20. Dr,Garje Mona P, Dr,VishnuDhawad, Ms.RashmiYeradkar,Dr. ArpitaAdikari “Study Of visual perceptual problems in children with learning disability”, Indian journal of basic and applied Medical research; June 2015; vol 4 issue - 3 p. 492 – 497.

21. Eden G, Stein J, Wood M, Wood F. “Verbal and visual problems in reading disability. Journal of Learning Disabilities”, 28 (5): 272-290. 1995.

22. Eden GF, Stein JF, Wood HM, Wood, FB. “Differences in eye movement and reading problems in dyslexic and normal children”. Vision Research 34 (10): 1345-1358, 1994.

23. Erich Kasten Ulrike Bunzenthal Bernhard A.Sabel "Visual field recovery after vision restoration therapy (VRT) is independent of eye movements: An eye tracker study".

24. Fischer, Hartnegg, Klaus. "Effects of visual training on saccade control in dyslexia. Perception" 29: 531-542, 2000.

25. Garje Mona P, Vihnu Dhadwad, Assistant Professor, "Study of Visual Perceptual problems in children with learning disability", Indian Journal of Basic and applied Medicatrion research 2015,

26. GiseliDonadonGermano et.al; "Visual Motor perception of the students with attention deficit hyperactivity disorders". (2013)

27. Grisham D, Sheppard M, Tran W. "Visual symptoms and reading performance". Optometry and Vision Science 70 (5): 384-391, 1993.

28. Harris P. Learning-related visual problems in Baltimore City: "A Long-Term Program". Journal of Optometric Vision Development 33 (2): 75-115, 2002.

29. JameelRizwanaHussaindeen, Prerana Shah et.al "Efficacy of Vision therapy in children with learning disability and associated binocular vision anomalies", June 2017

30. Jane case smith,EdD,OTRL/ BCP Associate Professor "Effect Of occupational Therapy services on Fine Motor and Functional performance in Preschool children".Case-Smith J. (2000) American journal of Occupational Therapy 54, 372 – 380.

31. Maples W.C. "Visual factors that significantly impact academic performance". Optometry 74 (1): 35-39, 2003

32. McKane F, et al. "A comparison of auditory/ language therapy with school visual support procedures in a public school setting". Journal of Optometric Vision Development 32 (2): 83-92, 2001.

33. Oliver CE; "A Sensorimotor program for improving writing readiness and skills". American journal of Occupational therapy 1990.

34. Orfield A, Basa F, Yun J. “Vision problems of children in poverty in an urban school clinic”: Their epidemic numbers, impact on learning, and approaches to remediation. Journal of Optometric Vision Development 32 (3): 114- 141, 2001.

35. ReepaSanghavi MOT student and RajniKelkar MOT,’ “Visual Motor Integration and learning disabled Children,” The Indian Journal of Occupational Therapy: Vol. XXXVII: No. 2 (August - November, 05)

36. Richard L. Metzger, David B. Werner“Recovery of visual field defects: A large clinical observational study using vision restoration therapy”

37. Rounds BB, Manley CW, Norris RH. “The effect of oculomotor training on reading efficiency”. Journal of American Optometric Association 62 (2): 92-99, 1991.

38. Sigler G, Wylie T. “The effect of vision therapy on reading rate”: A pilot study. Journal of Behavioral Optometry 5 (4): 99-102, 1994.

39. Simons H, Grisham, J.D. “Binocular anomalies and reading problems”. Journal of the American Optometric Association. 58 (7): 578-587, 1987.

40. Solan H, Larson S, Shelley-Tremblay J, Ficarra A, Silverman M. “Role of visual attention in cognitive control of oculomotor readiness in students with reading disabilities”. Journal of Learning Disabilities 34 (2): 107-118, 2001.

41. Solan, H., Shelley-Tremblay, J., et al. “Effect of Attention Therapy on Reading Comprehension. Journal of Learning Disabilities” 36(6): 556-563, 2003.

42. Sterner B, Abrahamsson M, Snowstorm A. “Accommodative facility training with a long term follows up in a sample of school aged children showing accommodative dysfunction”. DocumentaOphthalmologica 99: 93-101, 1999.

43. Streff JW, Poynter HL, Jinks B, Wolff B. “Changes in achievement scores as a result of a joint optometry and education intervention program”. Journal of the American Optometric Association 61 (6): 475-81, 1990.

44. Tamara Avi-itzhak Doris R Obler et.al"Testing the Cross - cultural clinical utility of the VMI for Palestinian, Israeli and American typically developing kindergarten children",(2014).

45. Taylor Kulp M, Edwards K, Mitchell L. "Is visual memory predictive of below- average academic achievement in second through fourth graders" Optometry and Vision Science 79 (7): 431-434, 2002.

46. Taylor Kulp M, Schmidt P. Effect of oculomotor and other visual skills on reading performance: A literature review. Optometry and Vision Science 73 (4): 283-292, 1996.

47. Taylor Kulp M, Schmidt P. "The relation of clinical saccadic eye movement testing to reading in kindergartners and first graders". Optometry and Vision Science SEP 74 (1):37-42, 1997.

48. Taylor Kulp M, Schmidt P. "Visual predictors of reading performance in kindergarten and first grade children. Optometry and Vision Science", 73(4): 255- 262, 1996.

49. Taylor Kulp M. "Relationship between visual motor integration skill and academic performance in kindergarten through third grade". Optometry and Vision Science 76 (3): 159-163, 1999.

50. Vijayalaxmi V. Mogassale.Vishwanath D. Patil et.al "Prevalence of specific Learning Disabilities among Primary School Children in a South Indian Study",December 2011.

51. Young B, Collier-Gary K, Schwing S. Visual factors: "A primary cause of failure in beginning reading". Journal of Optometric Vision Development, 32 (1): 58-71, 1994.

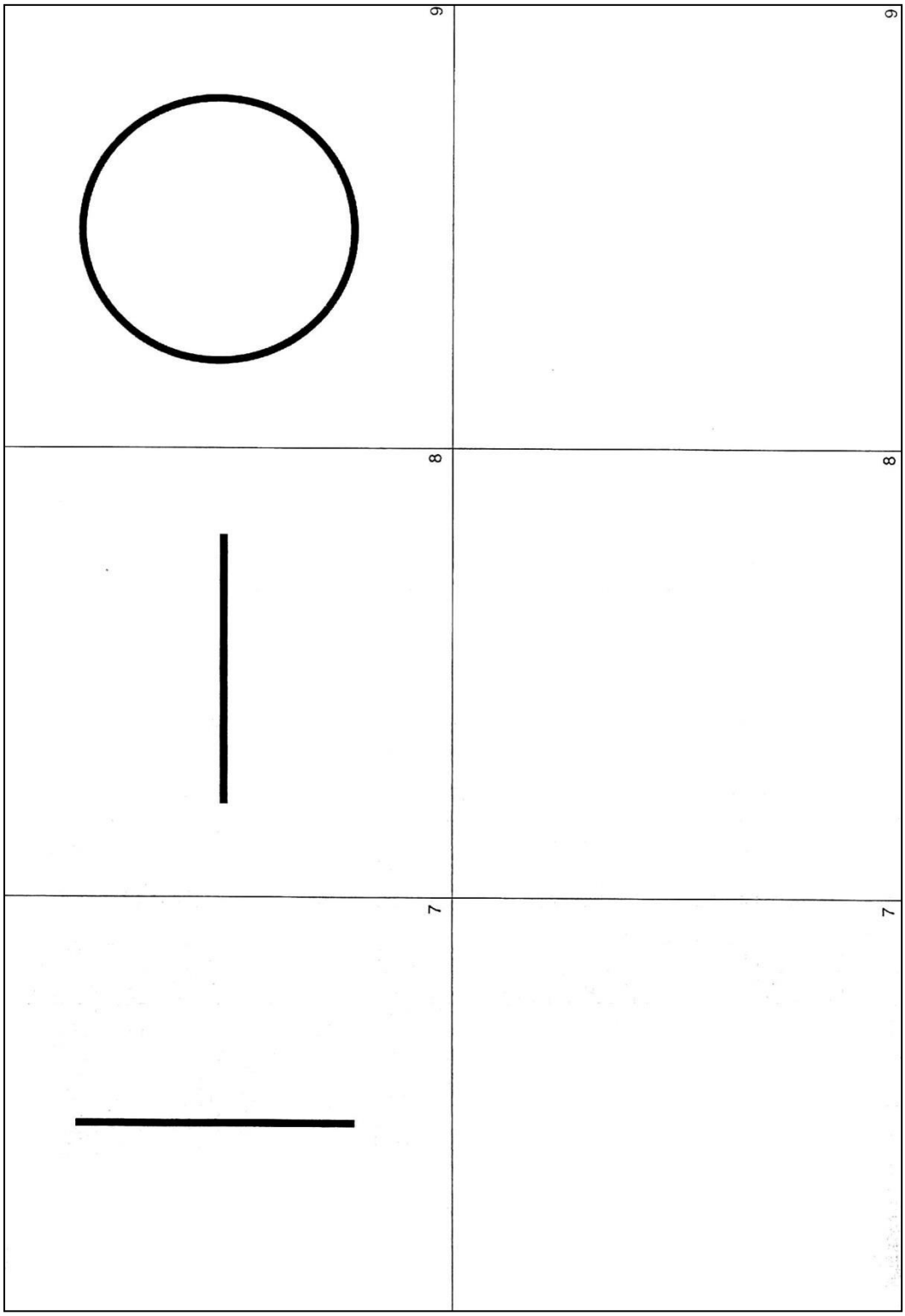
Websites

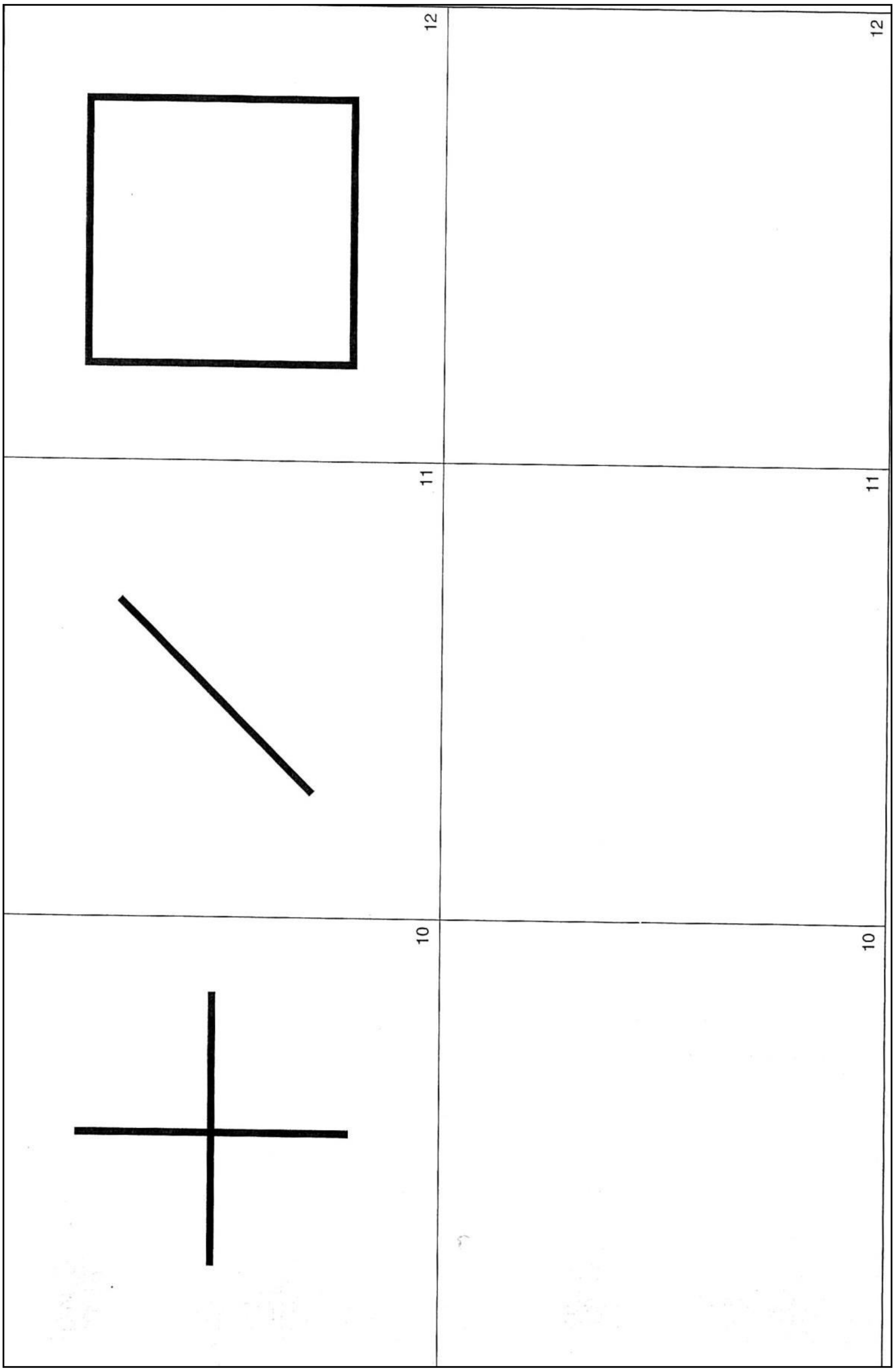
- www.google.com
- www.pubmed.com
- www.medline.com

- www.learning disability.com
- www.ldonline.org
- https://ldaamerica.org
- www.smartkidswithld.org
- https://www.ncld.org
- www.paediatrics.org
- www.schoolbehaviour.com
- www.database.com
- www.graphpadonline.com
- www.OTseeker.com

APPENDIX – I

VISUAL MOTOR INTEGRATION SCALE

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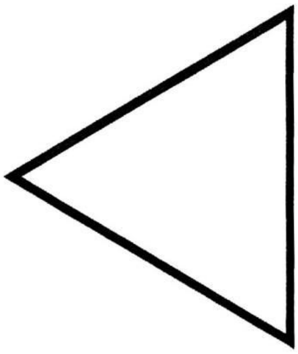

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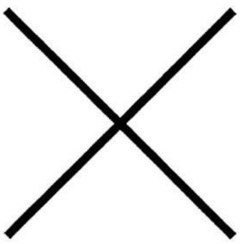

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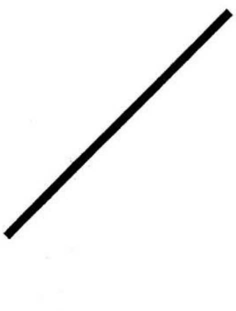

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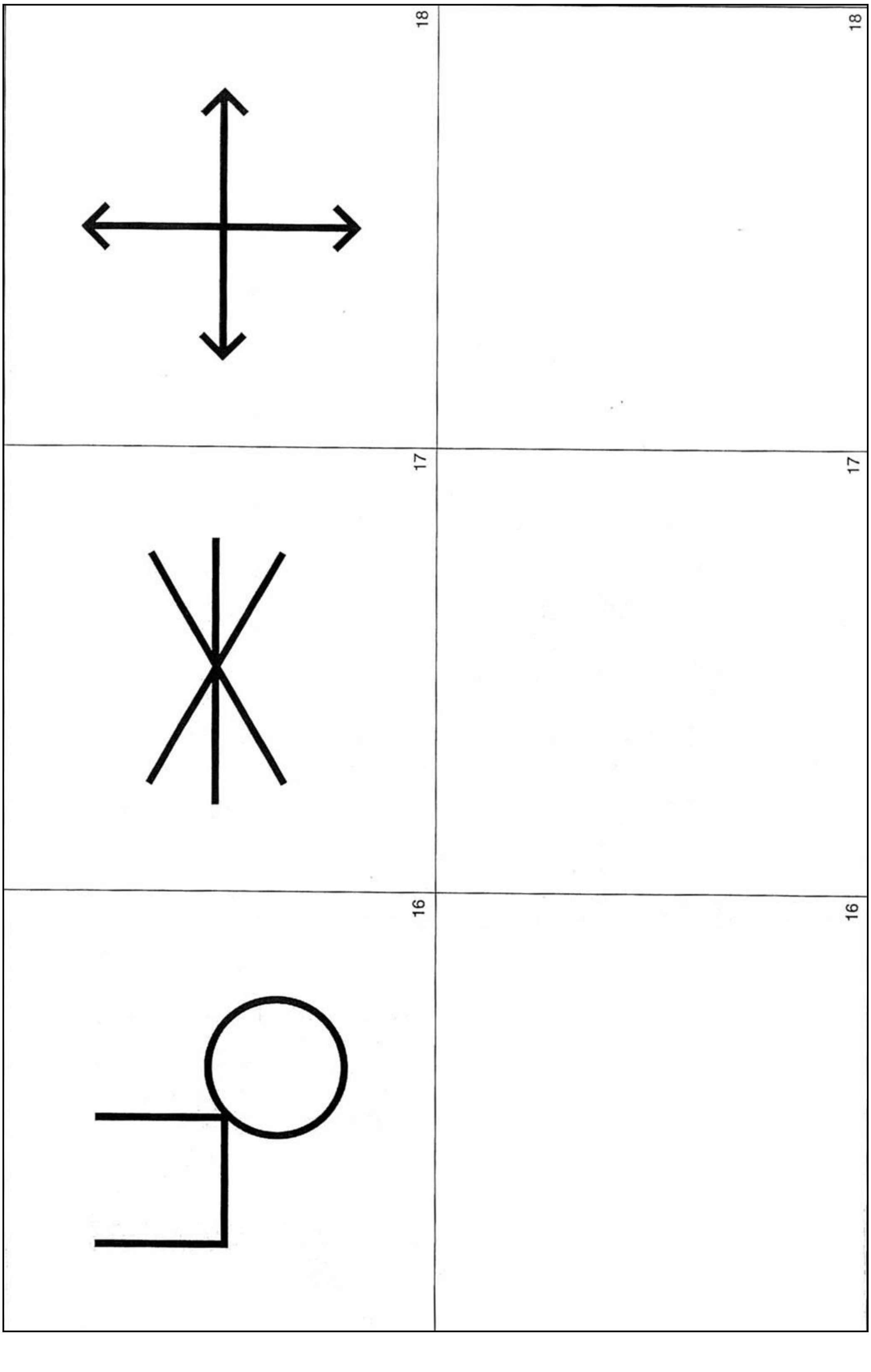
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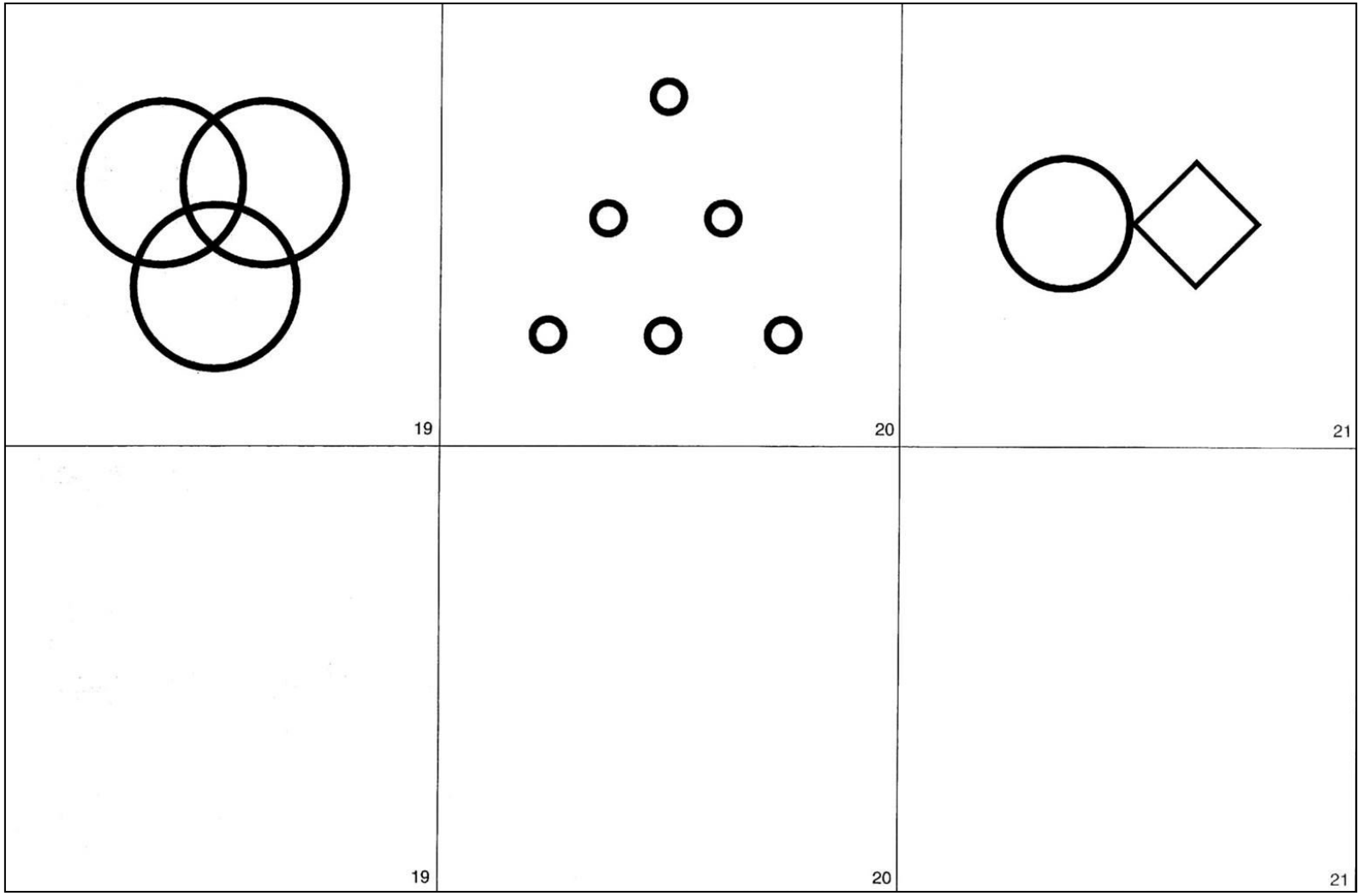
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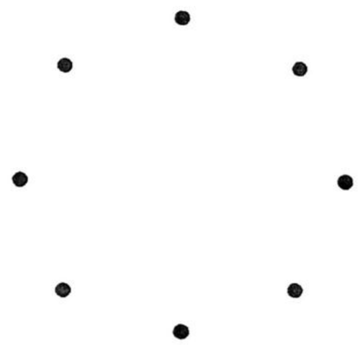

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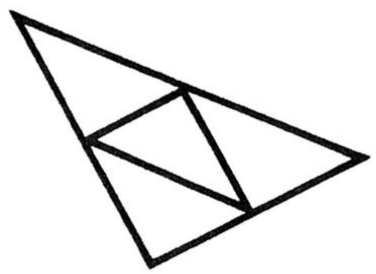

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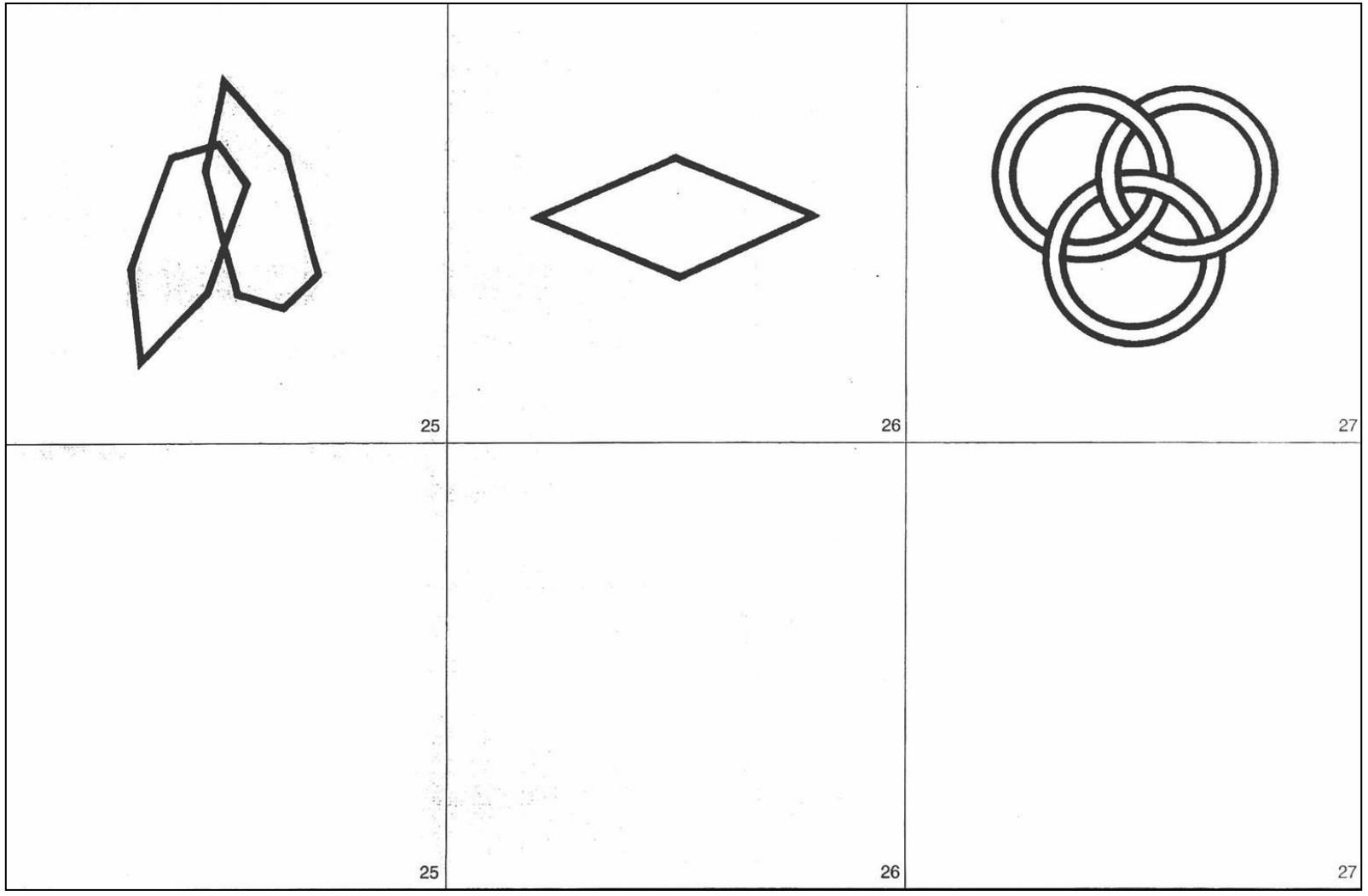
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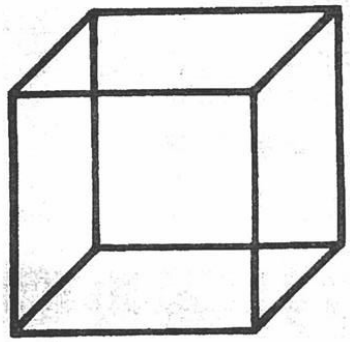

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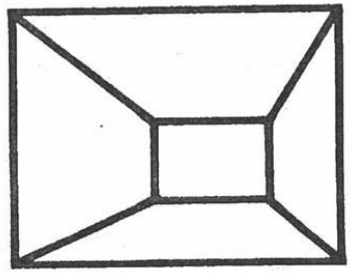

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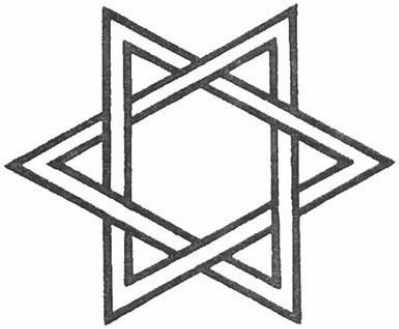

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MASTER CHART

CONTROL GROUP

Subject Code		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Age		7.2	7.0	8.3	10	9.5	7.8	7	9.4	9	10	8.9	8	7.6	7.6	10
Sex		M	M	M	M	M	F	M	M	M	M	M	F	M	M	M
VMI	Pre test	12	13	13	10	13	14	12	17	11	12	10	13	13	10	12
	Post test	13	13	16	11	12	14	15	17	12	13	10	13	13	11	13

EXPERIMENTAL GROUP

Subject Code		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Age		9	7.5	8.6	7.1	8.3	10	9.3	7.4	7.8	9.4	8.7	7.2	8	10	9.5
Sex		M	M	M	M	M	M	M	M	M	M	M	F	M	M	M
VMI	Pre test	12	13	13	10	13	14	14	12	10	13	13	10	12	17	12
	Post test	15	17	16	13	16	15	17	14	13	15	17	14	14	20	15

Ph : 0091 - 04288 - 260032, 260588

J.K.K.MUNIRAJAHH MEDICAL RESEARCH FOUNDATION

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Rtn. MPHF. **Dr. J.K.K. MUNIRAJAHH** M.Tech., (Bolton)
Correspondent

MOT/Project-Permission/2017

Date : 19.08.2017

To
The Director,
NIMHANS,
Hosur Road,
Bengaluru,
Karnataka - 560 029.

Respected Sir/Madam,

Sub: Regarding permission to project data collection.

* * *

With reference to the subject cited above, our Master of Occupational Therapy Second year student **SRINITHYA.G.** is doing a project on the topic "Efficacy of Vision Therapy as an Adjunct to Occupational Therapy in Learning Disability". She likes to collect data from your institute from Department of Neuro Rehabilitation and Child Psychiatry Department. So, we request you to give permission for the above student to collect the data for her project.

Thanking you,

Yours sincerely,

PRINCIPAL
JKKMMRF COLLEGE OF
OCCUPATIONAL THERAPY
KOMARAPALAYAM - 638 183

Nimhans DPNR Department
25.8.2017
Bangalore-29.

APPENDIX – II

CONFIDENTIALITY

Your name will not be associated with the result in this study. It will be for both teaching and research purpose. Only myself and my guide will have access to the name of the subjects participating in this study.

The following is the name address and telephone number of the person to be contacted in event of research related inquiry.

Name : Mrs.Srinithya.G

Address : JKKMMRF College of Occupational Therapy

Komarapalayam, Namakkal District.

A CONSENT FORM INFORMED CONSENT

I have been informed about the study, “Efficacy of vision therapy as an adjunct toOccupational Therapy in learning disabled children”, and have been invited to participate in the same. I have been informed about the importance of the study. I have understood that I have the right to refuse my consent at any time, during the study without adversely affected my treatment at NIMHANS. I have read this consent form and have been given the opportunity to ask questions.

The contents of this consent form were read out and explained to me in the local language in which I am conversant and I have signed this document after having understood the contents completely.

I ....., the undersigned, give my consent for participation on my own accord.

Signature/thumb impression of participant

Name:

Date :

Signature of Investigator Name:

Designation: Place:

Date: